

W1.35:3-378

# TM 3-378

WAR DEPARTMENT TECHNICAL MANUAL

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## MANIFOLD, PORTABLE FLAME THROWER, E4

**RESTRICTED:** DISSEMINATION OF RESTRICTED MATTER.  
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WAR DEPARTMENT,

Washington 25, D. C., 3 March 1945

TM 3-378, Manifold, Portable Flame Thrower, E4, is published for the information and guidance of all concerned.

[A.G. 300.7 (20 Feb 45)]

By order of the Secretary of War:

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Chief of Staff.

OFFICIAL:

J. A. ULIO,  
Major General,  
The Adjutant General.

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Refer to FM 21-6 for explanation of distribution formula.

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## SAFETY PRECAUTIONS

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Handle flame thrower fuels as carefully as motor fuel to prevent premature ignition (AR 850-20).</li> <li>2. Handle compressed air or nitrogen in accordance with AR 850-60.</li> <li>3. Handle and store ignition cylinders</li> </ol> | <ol style="list-style-type: none"> <li>as ammunition. They contain incendiary material.</li> <li>4. Do not fire ignition cylinders unless weapon is being used to fire fuel.</li> <li>5. Never send untrained firers or assistants on a mission.</li> </ol> |
|---|---|

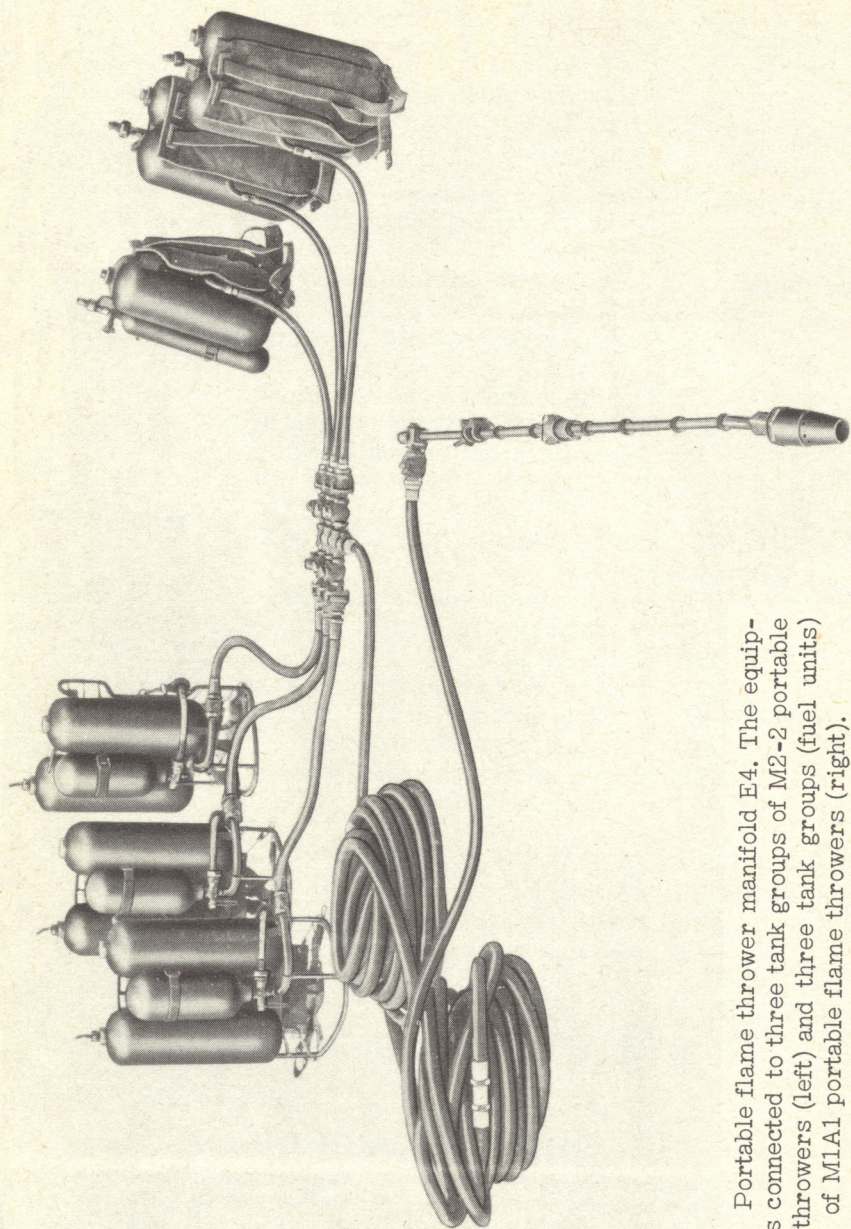


Fig. 1. Portable flame thrower manifold E4. The equipment is connected to three tank groups of M2-2 portable flame throwers (left) and three tank groups (fuel units) of M1A1 portable flame throwers (right).

# PART ONE

## INTRODUCTION

---

### Section I. GENERAL

#### 1. Scope.

a. This Technical Manual is published to inform and guide personnel to whom the manifold, portable flame thrower, E4 is issued.

b. It includes part one, introduction; part two, operating instructions; part three, maintenance instructions; and part four, auxiliary equipment. Storage and shipping information and a list of references are given in the appendix.

c. In all cases where the nature of the repair, modification, or adjustment is beyond the scope or facilities of the unit, the responsible Chemical Warfare Service officer should be notified in order that trained personnel with suitable tools and equipment may do the work or issue proper instructions.

#### 2. Records.

Although no standard maintenance forms and records are furnished, an improvised list should be kept of the number of times the equipment is used. The list indicates when it is necessary to provide preventive maintenance services and lubrication. It also should include space for listing of repairs and replacement of parts or assemblies. The record for each gun should be kept with the gun. Malfunctions or suggested improvements should be reported through a Chemical Warfare Service officer to Office of the Chief, Chemical Warfare Service.

### Section II. DESCRIPTION AND DATA

#### 3. General.

The equipment (fig. 1) consists basically of a special portable flame thrower manifold gun E10R1, a manifold assembly (fig. 2), 200 feet of hose, and two packboards.

a. Manifold assembly. Use of a manifold assembly permits several times as much fuel as usual to be fired from a portable flame thrower gun before refilling.

(1) The manifold assembly permits grouping of as many as six standard M2-2 or M1A1 portable flame throwers (without guns) but with the special manifold gun attached.

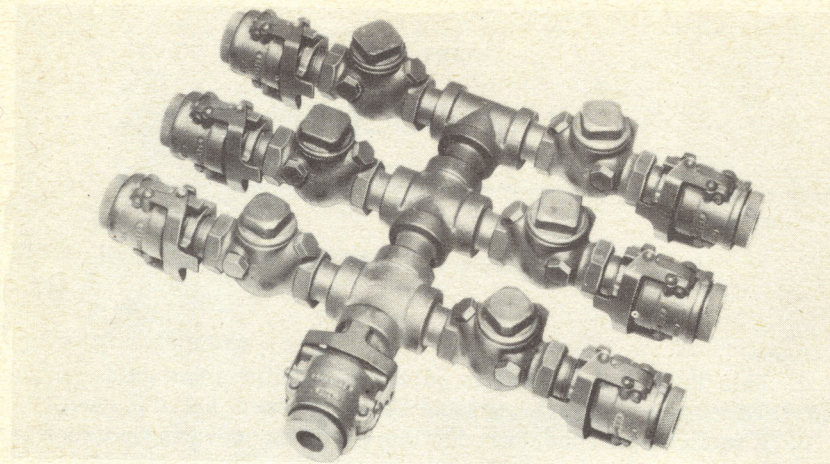


Fig. 2. Manifold assembly (with coupling plugs in inlets and outlet).

(2) The manifold gun and hose may be connected alternately to a mechanized flame thrower fuel and pressure unit.

(3) If desired, the gun from an M2-2 portable flame thrower may be used instead of the E10R1 manifold gun.

b. Hose and gun. The weapon is designed especially for use in jungle or thick underbrush, through which the long hose may be drawn undetected by the enemy. The 200-foot hose (or a shorter section of the hose) is connected to the manifold assembly and the special gun; thus, in some situations, the flame thrower firer can approach the target with less danger of detection because of the lower silhouette, less interference from underbrush, and less vulnerability than if he were carrying the fuel and pressure tanks of a portable flame thrower.

c. Packboards. Two plywood packboards are provided for carrying the hose.

d. Personnel. A squad of approximately four to six men is necessary for emplacing and operating the weapon.

#### 4. Identification information.

A brass name plate, riveted on each gun, bears the Chemical Warfare Service nomenclature, lot number, serial number, and manufacturer's name. This information should be given when requisitioning spare parts or when having equipment repaired.

#### 5. Tabulated data.

All data are approximate.

##### a. Weights.

	<u>Pounds</u>
Gun, manifold, portable flame thrower, E10R1. ....	11
Gun nozzle-end. ....	4
Gun control-end. ....	7
Hose, 200 feet (two 100-foot lengths -- 45 pounds each) .....	90

	<u>Pounds</u>
Manifold assembly . . . . .	21
Packboard (two -- 4-1/2 pounds each) . . . . .	9
Complete equipment in the three boxes . . . . .	267
Box No. 1, with contents . . . . .	107
Box No. 2, with contents . . . . .	80
Box No. 3, with contents . . . . .	80
Tool kit (in carton) . . . . .	7
Accessories kit (in carton) . . . . .	12
Spare parts kit (in carton) . . . . .	2

b. Dimensions.

Box No. 1 (outside) . . . . .	22-1/2 inches x 59-1/2 inches x 10 inches
Box No. 2 (outside) . . . . .	27-3/4 inches x 27-3/4 inches x 13 inches
Box No. 3 (outside) . . . . .	27-3/4 inches x 27-3/4 inches x 13 inches
Gun (connected length) . . . . .	108 inches
Halves of gun (disconnected) . . . . .	56 inches
Hose (length over-all) . . . . .	200 feet
Hose (length of sections) . . . . .	100 feet
Manifold assembly . . . . .	16-1/4 inches x 12-3/4 inches x 3-1/4 inches

c. Capacity of weapon.

Maximum number of portable flame throwers which may be connected to gun through manifold . . . . .	6
Fuel capacity, using six filled M2-2 or M1A1 portable flame throwers . . . . .	24 gallons
Ignition cylinders (each cylinder contains five incendiary charges each burning 10 seconds) . . . . .	1 cylinder per gun
Duration of fire (not including time between bursts) using six portable flame throwers M2-2 or M1A1 at manifold (depending on type of fuel) . . . . .	30 to 60 seconds
Range, liquid fuel . . . . .	20 yards
Range, pourable thickened fuel . . . . .	30 yards

### Section III. TOOLS, PARTS, AND ACCESSORIES

**6. Items with each portable flame thrower manifold.**

The following tools (fig. 3), parts (fig. 4), and accessories (fig. 5) are packed with each portable flame thrower manifold E4 (subject to minor changes):

a. Tool kit.

<u>Quantity</u>	<u>Nomenclature</u>	<u>CWS Stock Number</u>
1	Screwdriver, common, normal duty, 4-inch blade	H22-50-22
1	Pliers, combination, slip joint, wire cutting, 6-inch	H22-29-9
1	File, American Standard, flat, bastard, 10-inch	H22-108-10

<u>Quantity</u>	<u>Nomenclature</u>	<u>CWS Stock Number</u>
1	Wrench, adjustable, crescent type, single end, 12-inch	H22-49-100
1	Wrench, screw, monkey, metal handle, 15-inch	H22-49-123
2	Wrench, socket head screw, 1/16-inch hex. (for No. 6 set screw)	H22-49-10
2	Wrench, socket head screw, 3/32-inch hex. (for No. 10 set screw)	H22-49-11

b. Spare parts kit.

<u>Quantity</u>	<u>Nomenclature</u>	<u>CWS Stock Number</u>
1	Lubricant, aluminum thread (1/2-pound can)	H99-4-17
6	Screw, set, socket head, cup point, S., No. 6, 32 NC x 3/16-inch	H22-17-2
6	Screw, set, socket head, cup point, S., No. 10, 24 NC x 5/16-inch	H22-17-111
24	Washer, coupling	A81-1-513
1	Case, spring, assembly	B81-1-444

c. Accessories kit.

<u>Quantity</u>	<u>Nomenclature</u>	<u>CWS Stock Number</u>
6	Coupling, pipe, reducing, galvanized, 3/4-inch x 1/2-inch	H98-5-215
6	Coupling, tank, assembly	C81-1-509
12	Bushing, pipe, outside hd., galvanized, 3/4-inch x 1/2-inch	H98-5-93
6	Nipple, pipe, long, galvanized, 1/2-inch x 5-inch	H98-5-156
6	Nipple, pipe, short, galvanized, 3/4-inch x 2-inch	H98-5-318
6	Nipple, tank coupling	E81-6-140

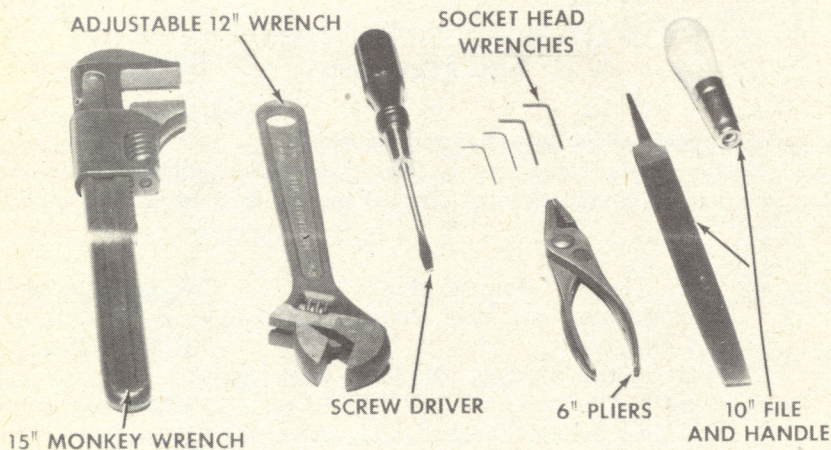


Fig. 3. Tool kit contents.

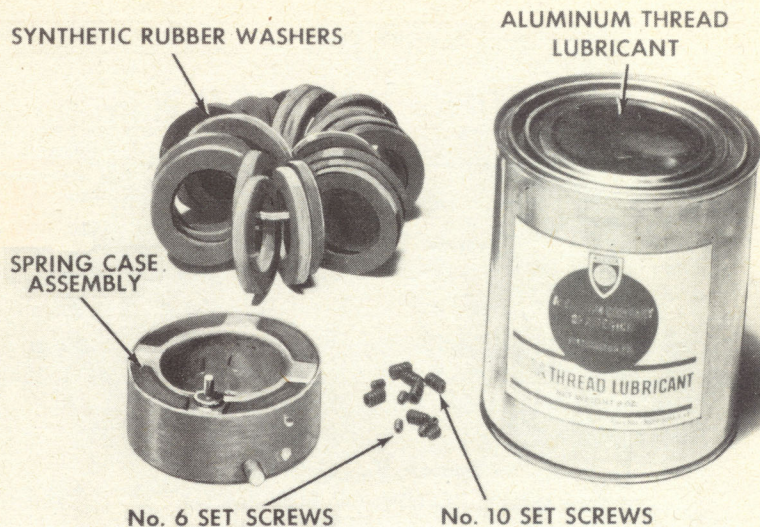


Fig. 4. Spare parts kit contents.

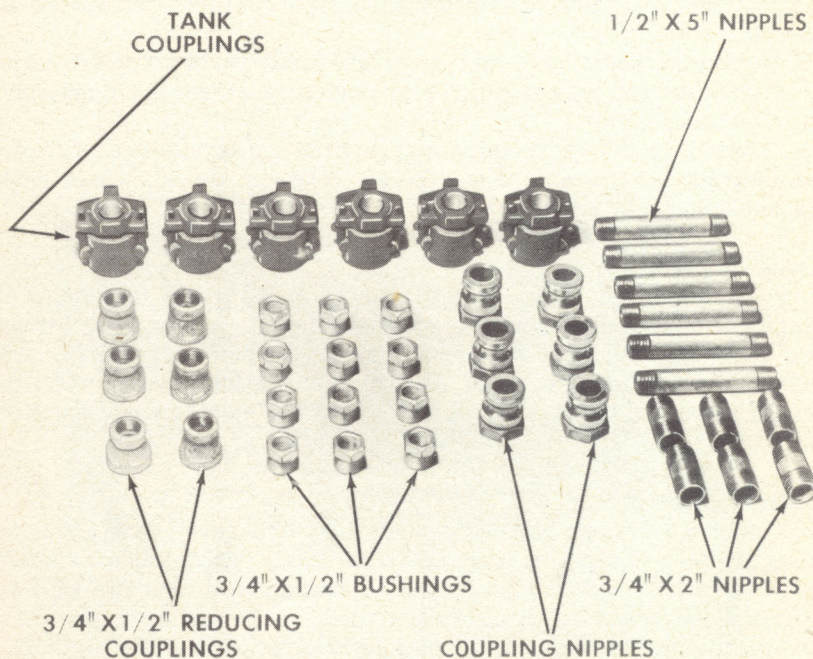


Fig. 5. Accessories kit contents.

**PART TWO****OPERATING INSTRUCTIONS**

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**Section IV. GENERAL****7. Scope.**

Part two of this Technical Manual contains information for the guidance of personnel responsible for operation of the equipment. It includes information on controls and methods of operation.

**Section V. SERVICE  
UPON RECEIPT OF EQUIPMENT****8. General.**

a. Upon receipt of new or used materiel, it is the responsibility of the officer in charge to ascertain whether it is complete and in sound operating condition. A record should be made of missing parts and malfunctions, and such conditions should be corrected as quickly as possible.

b. Attention should be given to small and minor parts which are likely to become lost and loss of which may seriously affect the functioning of the materiel.

c. Materiel should be cleaned and prepared for service in accordance with instructions given in paragraph 39. The gun should be lubricated in accordance with paragraph 37.

**9. New equipment.**

Open packing boxes (figs. 6 and 7). Check packing list to be sure all equipment is present. Examine and test all parts and assemblies for good condition. Remove rust preventive compound. Try all controls (pars. 12-15) for easy operation. Before use on a mission, test fire the weapon. Save packing boxes for storage of the equipment when it is not in use.

**10. Used equipment.**

When used equipment is received, it should be serviced in the same manner as new equipment (par. 9); in addition, parts and assemblies should be examined for signs of wear. Parts so worn that they will not withstand continued use should be replaced. If the fuel hose is worn or damaged in small areas only, it may be repaired or shortened (par. 51). Detailed information on adjustments, maintenance, and repair of other parts and assemblies is given in paragraphs 42 through 54.

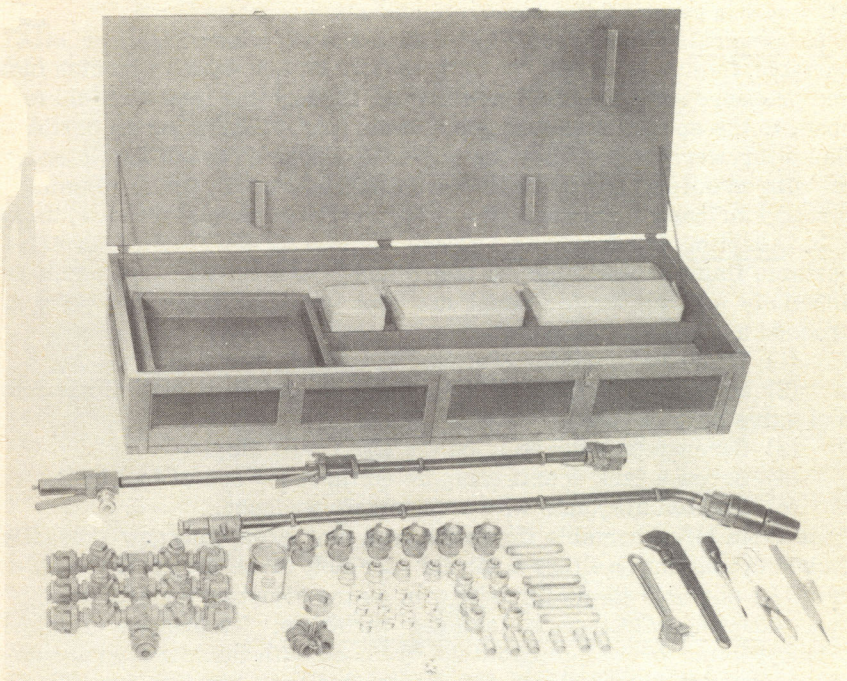


Fig. 6. Contents of Box No. 1 laid out in front of box.

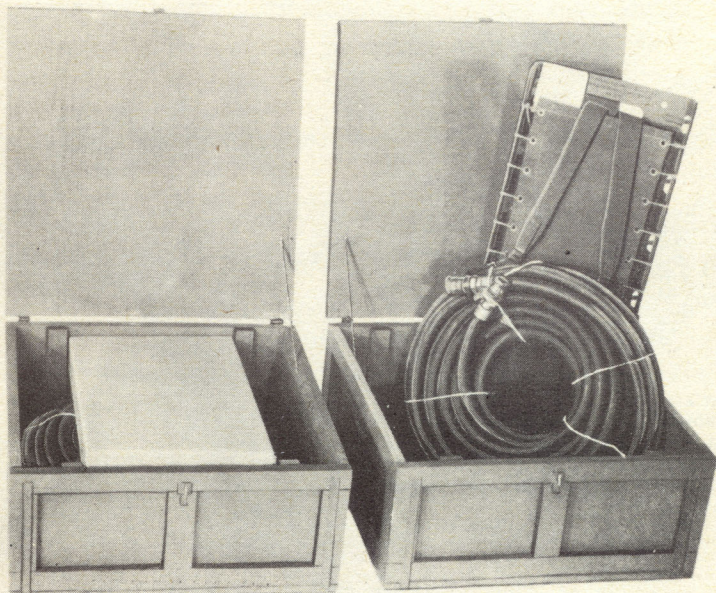


Fig. 7. Hose and packboard in opened Box No. 2 and Box No. 3.

**11. Adapting portable flame throwers for use with manifold.**

a. General. Tank groups and fuel hose, of either M2-2 or M1A1 portable flame throwers, or of both (fig. 1), are used to furnish fuel and pressure to the manifold, and thence, through the long manifold fuel hose, to the special manifold gun. Parts (par. 6) for adapting portable flame throwers so that they may be used either as originally intended or with manifold are included with each manifold. Apply aluminum thread lubricant, furnished with spare parts kit, on all threaded joints.

b. Adapting M2-2 portable flame throwers. To prepare an M2-2 portable flame thrower gun so that it may be used with the manifold assembly as well as for usual use as a portable flame thrower gun, proceed as follows (fig. 8):

- (1) Unscrew flame thrower fuel hose from valve body.
- (2) Screw a 3/4-inch by 2-inch galvanized short pipe nipple into fuel valve body of gun.
- (3) Screw a tank coupling on the short pipe nipple.
- (4) Screw a tank coupling nipple on threaded end of fuel hose.
- (5) Tighten all joints with appropriate wrenches.

Hose from M2-2 portable flame thrower tank group may now be readily locked in coupling on either manifold assembly or on the modified M2-2 or M1A1 portable flame thrower gun, as the situation necessitates.

c. Adapting M1A1 portable flame throwers. To prepare an M1A1 portable flame thrower gun so it may be used with the manifold assembly as well as for usual use as a portable flame thrower gun (fig. 9), proceed as in subparagraph (1) or (2) below:

- (1) Using fuel hose from M1A1 portable flame throwers.

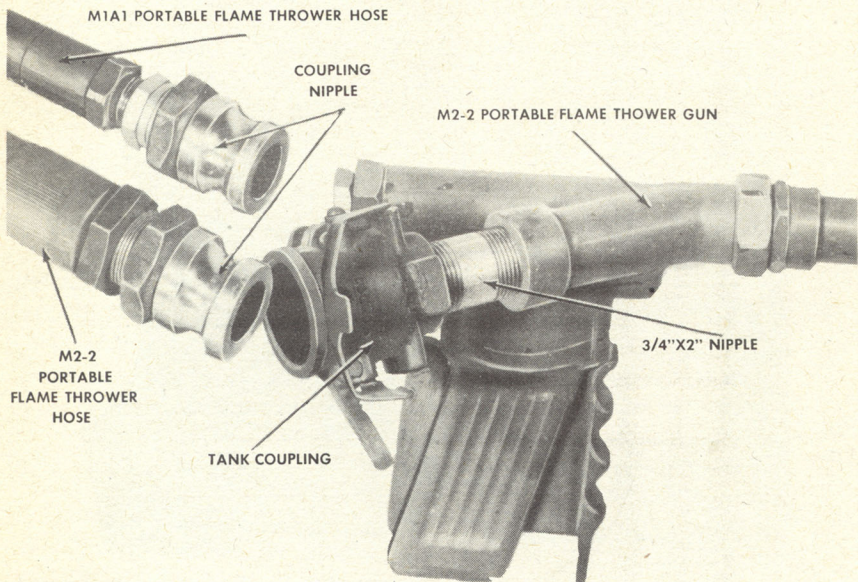


Fig. 8. Gun of M2-2 portable flame thrower adapted for hose.

- (a) Unscrew hose from gun, using wrench.
- (b) Screw a 1/2-inch by 5-inch galvanized long pipe nipple into fuel discharge valve opening.
- (c) Screw a 3/4-inch by 1/2-inch galvanized pipe bushing on 1/2-inch by 5-inch nipple.
- (d) Screw a tank coupling on 3/4-inch by 1/2-inch bushing.
- (e) Screw into M1A1 portable flamethrower fuel hose a 3/4-inch by 1/2-inch galvanized pipe bushing. This bushing is of the same type as that used in subparagraphs (c) and (d) above.

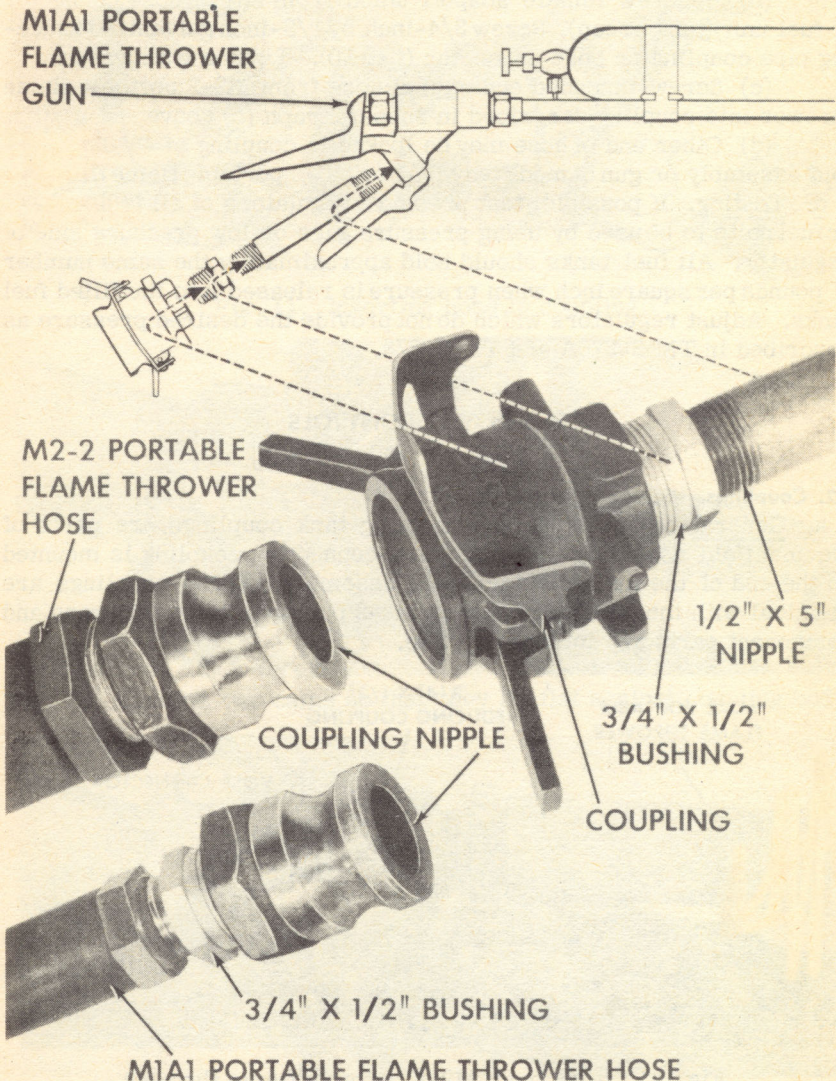


Fig. 9. Gun of M1A1 portable flame thrower adapted for hose.

(f) Screw a 3/4-inch by 1/2-inch galvanized pipe bushing (on end of hose) into a tank coupling nipple. Tighten with wrenches.

(g) Tank coupling nipple may either be locked in manifold coupling (when the equipment is to be used with the manifold assembly) or may be locked in the coupling on modified M1A1 or M2-2 portable flame thrower gun.

(2) Using fuel hose from M2-2 portable flame throwers.

(a) Follow procedure in subparagraph (1)(a) through (d) above to modify end of M1A1 portable flame thrower gun.

(b) Unscrew female adapter union from end of hose connector of fuel unit (tank group). Screw 3/4-inch by 1/2-inch galvanized reducing pipe coupling on hose connector (fig. 10). Tighten with wrench.

(c) Screw threaded end of fuel hose from M2-2 portable flame thrower into coupling described in subparagraph (b) above.

(d) Other end of hose may be locked in coupling of either manifold assembly or gun of modified M1A1 or M2-2 portable flame thrower.

d. Testing. If possible, test pressure regulators of all tank groups or fuel units to be used by using pressure gage on low pressure side of regulator. All fuel tanks should hold approximately the same number of pounds per square inch when pressure is released into the filled fuel tanks. Adjust regulators which do not provide the desired pressure as described in TM 3-376A and TM 3-375.

## Section VI. CONTROLS

### 12. Couplings.

a. General. Seven quick-connecting tank couplings are parts of the manifold assembly and one quick-connecting coupling is mounted on the end of the manifold fuel hose assembly. These couplings are identical with the tank couplings on M2-2 portable flame throwers and component parts are interchangeable.

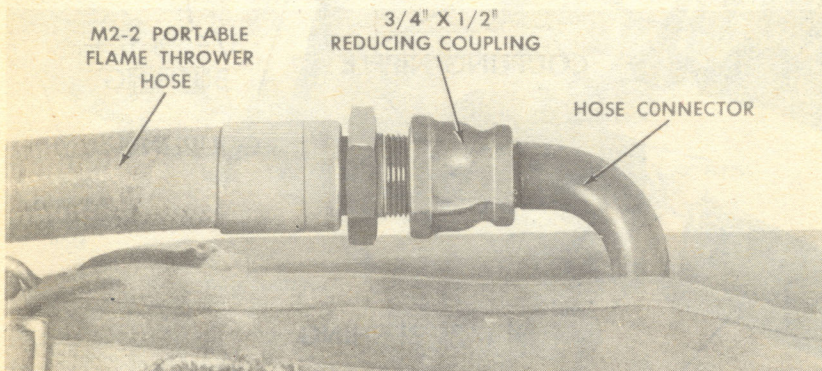


Fig. 10. Hose from M2-2 portable flame thrower connected to M1A1 fuel unit.

b. Connecting. To connect hose or coupling plug to coupling, proceed as follows:

(1) See if coupling washer, made of synthetic rubber, is in place in coupling body. If it is damaged or swollen, install new washer from spare parts kit.

(2) Insert unthreaded hose nipple or coupling plug in coupling as far as it reaches (fig. 11).

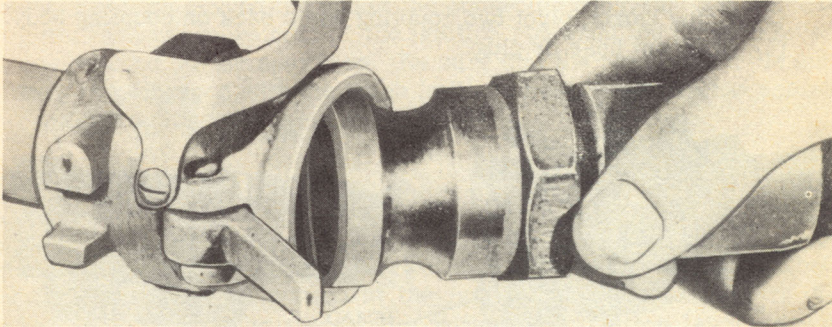


Fig. 11. Inserting hose in coupling.

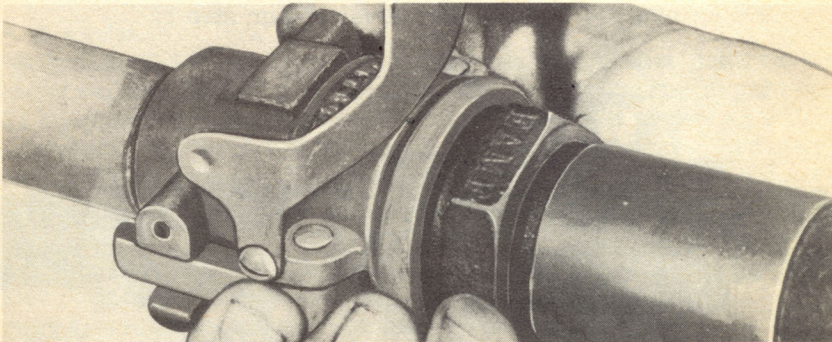


Fig. 12. Closing two cams so that they lie flat against coupling body.

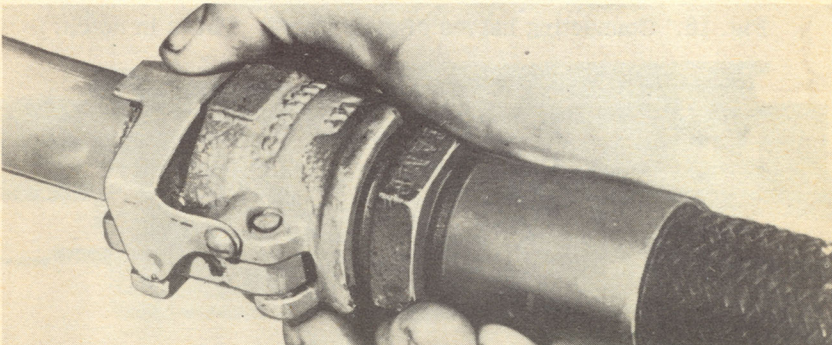


Fig. 13. Closing coupling lock all the way until it covers ends of cams.



**13. Gun connector.**

The gun connector consists of a female gun connector on the control-end and a male gun connector on the nozzle-end. It makes possible quick assembly of the two halves of the gun. The connector operates like a tank coupling (par. 12), with the male portion inserted in the female and locked by closing two cams and a lock (figs. 14-16). When connecting, be sure that the female connector plunger projects approximately  $1/4$  inch beyond the end of the connector body, so that contact is firm, insuring movement of the ignition rod when the ignition lever is compressed during operation. Be sure that the pin on the male gun connector is engaged with the notch in the female gun connector before attempting to close the cams and lock.

**14. Ignition lever.**

The ignition lever is mounted on the fuel pipe of the gun control-end. To operate, press safety lock lever open with finger (fig. 17) and compress ignition lever with hand. This causes the ignition rod to be pushed forward, resulting in ignition at the ignition head of the gun. If the safety lock lever is in the safety position, the ignition lever cannot move and push the ignition rod forward.

**15. Gun valve.**

The gun valve, located at the rear of the gun control-end, controls the flow of fuel through the gun. When opened, it permits fuel to pass under pressure from the hose to the nozzle; closed, it serves as a tight seal, preventing leakage of fuel and pressure from the hose. To operate, press safety latch (fig. 18) and squeeze valve handle. This permits passage of fuel from the hose through the gun and out toward the target. To stop flow of fuel through gun, release gun valve. Safety latch will lock the valve handle when valve handle is pushed away from valve body to its full stroke.

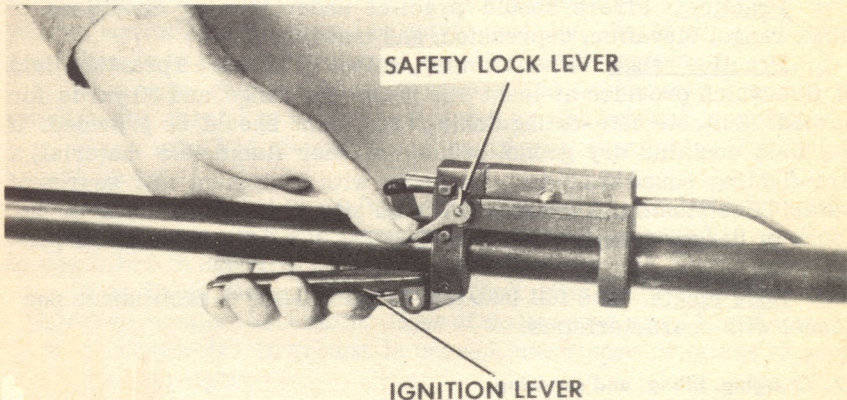


Fig. 17. Pressing safety lock lever.

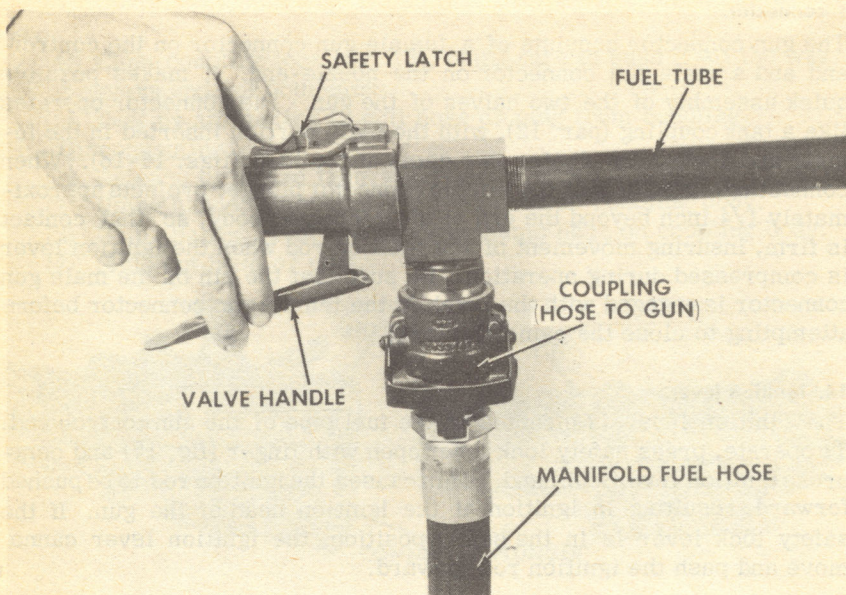


Fig. 18. Pressing safety latch on fuel valve before firing.

## Section VII. OPERATION UNDER USUAL CONDITIONS

### 16. Training.

Effective use of the flame thrower manifold can be achieved only by diligent training and practice with the weapon.

a. Practice. Firers should practice under varying conditions of wind, range, elevation, depression, and traverse.

b. Practice range. When training, select or prepare a practice field of fire which provides at least 125 yards for range and 30 yards for spread. Suitable fire-extinguishing equipment should be provided. If the field contains dry grass, brush, or other flammable material, a fire-fighting squad should be available with equipment and source of water. Assistants and observers should stay well behind the firer because of danger from wind shifts. See TM 3-376A for additional precautions.

c. Hose length. Use full 200-foot length of hose to familiarize personnel with characteristics.

### 17. Charging, filling, and servicing.

a. Before use on missions or for training, charge, fill, and service flame throwers as described in appropriate War Department publications.

b. Fuel tanks of all the flame throwers to be used simultaneously on a manifold assembly should have the same pressure setting (between 350 and 390 pounds per square inch). Adjust pressure regulators as necessary so pressures are as close to each other as can be readily obtained. Use one gage to test all fuel tanks as gages may vary.

**18. Carrying equipment to forward area.**

If equipment is to be manhandled to area where the manifold is to be set up, carry as follows:

a. Gun. One man may carry the split gun, the halves of which weigh 4 and 7 pounds.

b. Hose. One man can carry a 100-foot length of hose mounted on packboard. If both 100-foot lengths of hose are to be used, two men are required, one for each packboard.

c. Manifold assembly. One man can carry the manifold assembly lashed to one of the hose packboards or by other means of man pack.

d. M2-2 or M1A1 portable flame throwers. One man is required to carry each loaded and charged portable flamethrower. Do not release pressure into fuel tanks during the approach march unless it is desired to use the flame throwers as portable flame throwers instead of using them with manifold.

e. Additional fuel and pressure. If it is desired to fire the weapon at more targets than can be attacked with six flame thrower tank groups, extra fuel can be brought up in 5-gallon cans lashed to packboards together with replacement pressure tanks and ignition cylinders.

**19. Setting up manifold assembly.**

a. The weapon should be set up for operation at a well-concealed area close enough to target so that the manifold fuel hose assemblies reach the firing position without possibility of falling short. The manifold assembly, if possible, should be on a level with or higher than the gun firing position to keep pressure drop to a minimum. Consideration should be given to possible curves of the hose required by terrain. The weapon assembly area should be fairly level but should not be cleared more than is necessary to permit handling of the equipment.

b. Have men remove flame throwers and packboards from their backs, being careful to lower them to the ground without dropping.

c. Place manifold assembly on ground with manifold outlet facing toward target.

d. Remove coupling plugs from the couplings on manifold assembly (fig. 19). Hose from flame throwers may then be connected to manifold as described in subparagraphs g and h below.

e. Stand flame thrower tank groups (fuel units) in two parallel rows adjacent to manifold assembly. Hose of tank groups should lead toward manifold assembly. If ground is uneven, use stones or sticks to prop tank groups upright.

f. Disconnect any guns which may be connected to tank groups (fuel units) by disconnecting guns from hose. Do not remove hose from tank groups (fuel units).

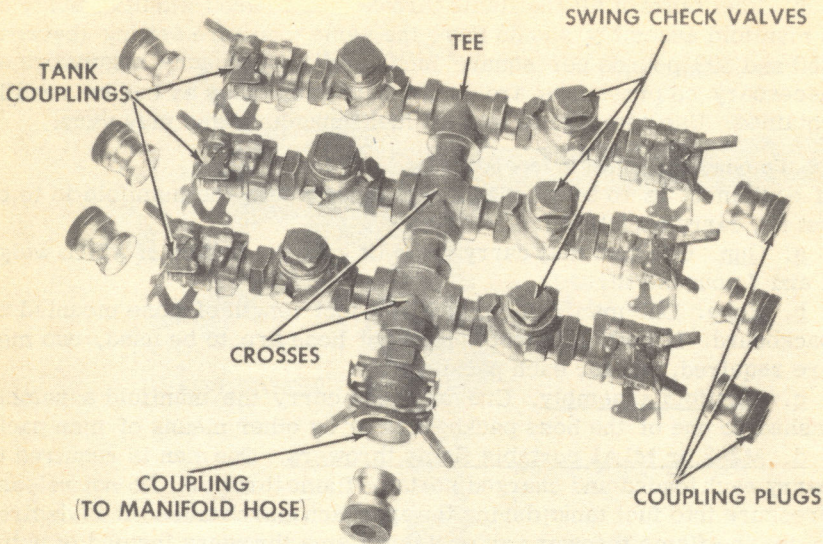


Fig. 19. Manifold assembly with coupling plugs removed.

(1) If M2-2 portable flame thrower fuel tanks have been pressured by opening of pressure tank valves, release this pressure before removing guns. To do so, close pressure tank valves. Then very slightly loosen plugs on top of fuel tanks by turning plugs with wrench, allowing the pressure to bleed from tanks. Do not completely unscrew the plugs. After pressure is bled, tighten plugs with wrench.

(2) If any M1A1 portable flame thrower fuel tanks have been pressured by opening of pressure cylinder valves, close fuel valves on tank groups (fuel units) before removing guns. When removing guns, open fuel discharge valve, allowing pressure to bleed from hose and hose connector before disconnecting.

g. If filled M2-2 portable flame throwers are brought up without guns and hose attached to tank groups, couplings on the tank groups should be kept closed with coupling plugs until the tank groups are to be connected to the manifold assembly. When ready to connect, place tank groups on sides so tank couplings are uppermost. If fuel tanks are not yet pressured, remove coupling plugs from tank couplings and install flame thrower fuel hose in couplings. Tank groups may then be stood on end as described in subparagraph e, above. If tank groups have been pressured, it is necessary to bleed pressure from fuel tanks, as in subparagraph f above, before removing coupling plug from tank coupling.

h. Holding manifold assembly and ends of hose (from flame throwers) above the top of fuel tanks, connect hose to manifold assembly (fig. 20). By holding them in air, escape of fuel is prevented. Place manifold assembly and hose on ground in previous positions.

i. Uncoil manifold fuel hose from packboard or packboards, laying hose on ground in front of manifold assembly as shown in figure 21. If two 100-foot lengths of manifold fuel hose are to be used, couple them before uncoiling front length.

j. Couple forward end of manifold fuel hose assembly to the gun (fig. 20).

k. Couple gun control-end and gun nozzle-end (par. 13).

l. Holding manifold assembly above the top of fuel tanks, remove coupling plug from front (outlet) coupling of manifold assembly. Connect rear end of manifold fuel hose assembly to this coupling. Place manifold assembly on ground (fig. 20).

## 20. Loading with ignition cylinder.

a. Preliminary. Before loading ignition cylinder in gun, test ignition system (par. 14) for operation.

b. General. Load an unused ignition cylinder (fig. 22) into the ignition head. Cylinders are packed two to a can. Do not open cans until ready to load for a mission.

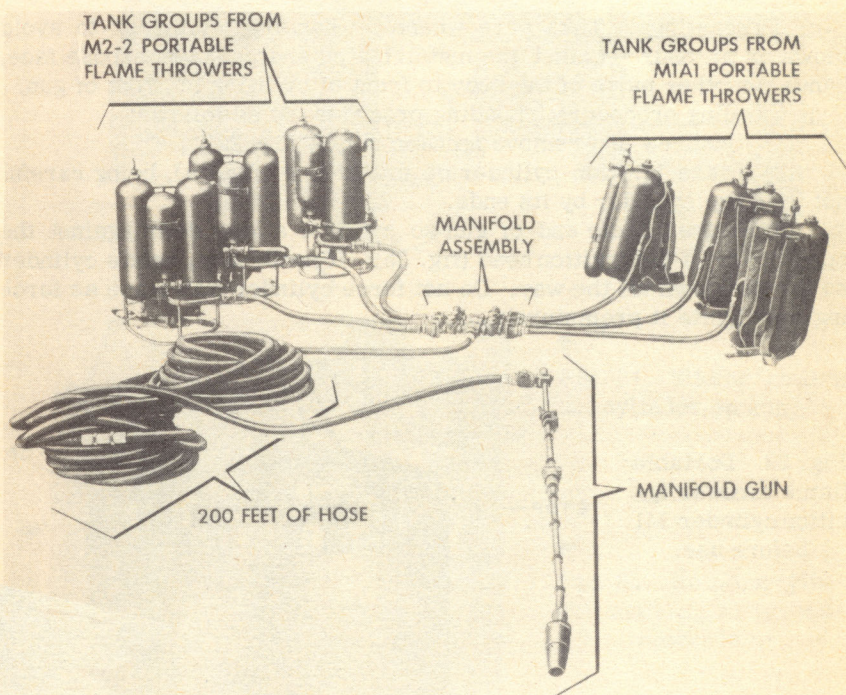


Fig. 20. Equipment assembled for operation. Any combination of as many as six M2-2 or M1A1 portable flame thrower tank groups may be used.

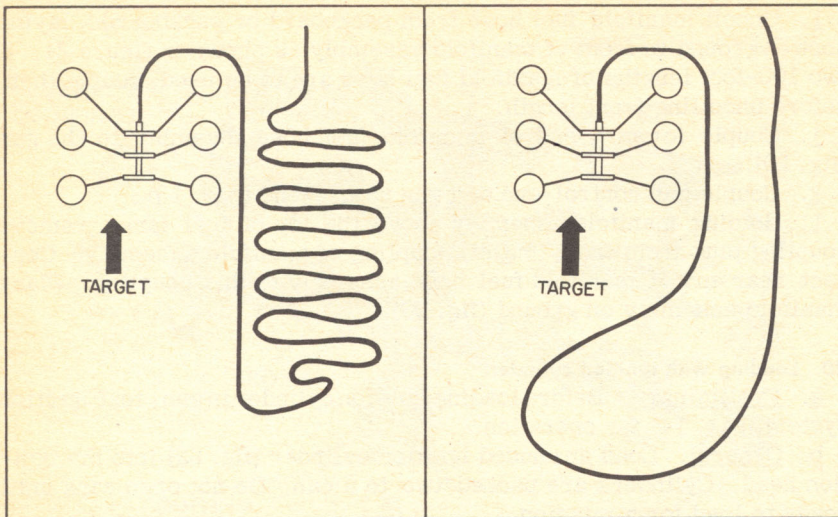


Fig. 21. Methods of uncoiling hose before carrying gun forward.

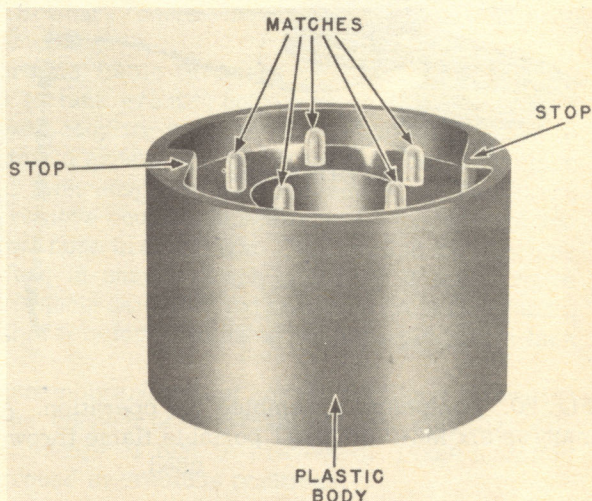
c. Precautions. Take care whenever handling cylinders to avoid blows or pressure against the metal match ends. Never expose face, hands, or other parts of the body to front of cylinder or front of gun.

d. Loading procedure. Loading procedure is as follows:

(1) Unscrew and remove ignition shield (fig. 23).  
 (2) Place ignition cylinder on end of gun (fig. 24), being careful not to grasp cylinder by its ends.

(3) Raise nozzle end of gun so cylinder slides down against the spring case of the ignitionhead (fig. 25). If necessary, rotate cylinder so it slips down all the way. Do not force cylinder into place as forcing may ignite it prematurely.

Fig. 22. Portable flame thrower ignition cylinder M1 before use.



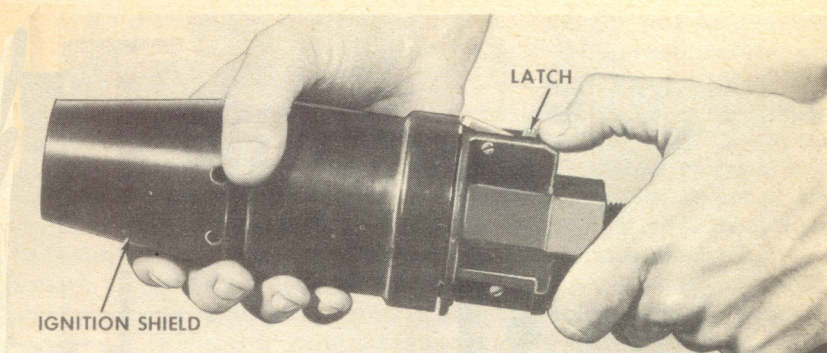
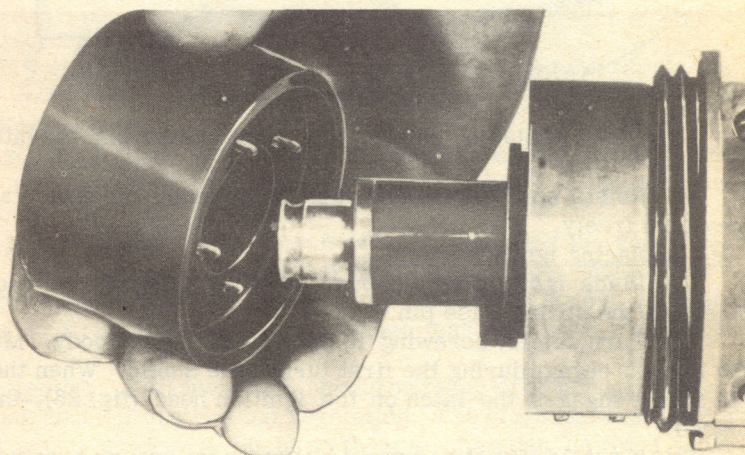
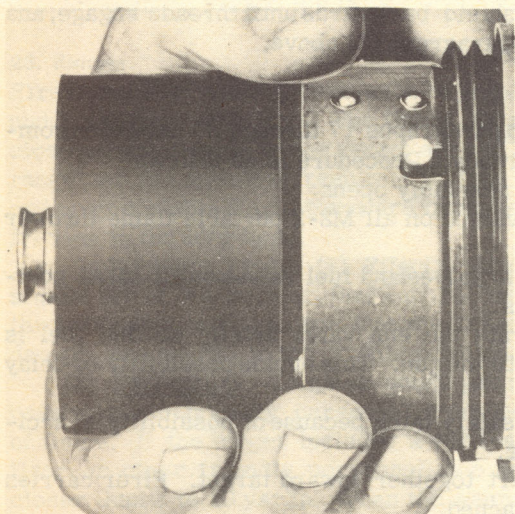


Fig. 23. Unscrewing ignition shield.



↑  
Fig. 24. Sliding ignition cylinder on gun.



←  
Fig. 25. Rotating cylinder and spring case clockwise.

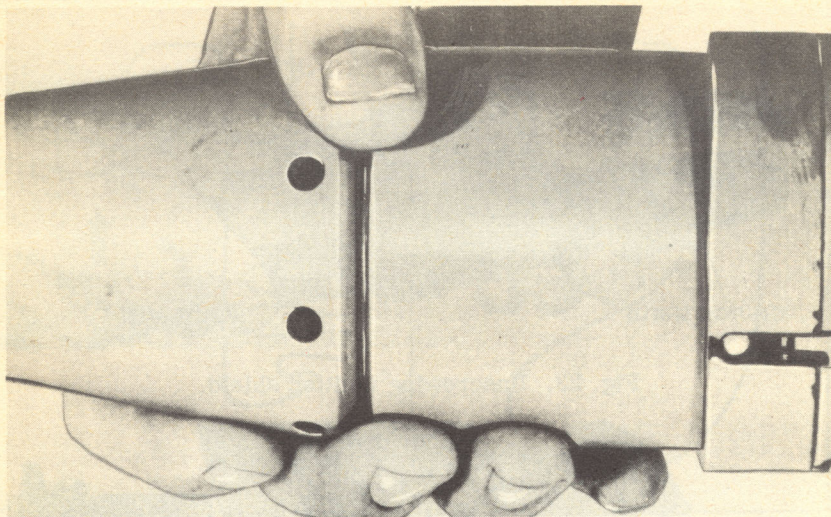


Fig. 26. Replacing shield. Slot must engage pin and latch.

(4) Rotate spring case and ignition cylinder clockwise as far as they turn freely.

e. Replacing ignition shield.

(1) Place ignition shield over cylinder. Engage the slot in the shield on the spring-case pin.

(2) Turn shield, screwing it onto ignition head body. Make sure the threads engage during the first turn of the shield. When the slot on the shield engages the latch on the ignition head (fig. 26), the gun is loaded.

(3) If shield cannot be turned by hand tight enough to engage latch, unscrew shield. Then turn shield backwards until threads engage, and repeat step described in subparagraph (2) above.

**21. Approach of firer to target.**

When operations described in paragraphs 17 through 20 have been completed, the weapon is made ready. Procedure is as follows:

a. A man at the manifold assembly opens:

(1) The pressure tank valves on all M2-2 portable flame thrower tank groups.

(2) The pressure cylinder valves and fuel valves on all M1A1 portable flame thrower fuel units.

b. The firer should operate the gun valve briefly so that fuel is brought up through the hose to the gun. This avoids possibility of delay at firing position.

c. Firer should reset the safety latch because of possibility of accidental pressure on gun valve.

d. Firer and hosemen start together toward target. Firer carries assembled gun with hose attached.

e. If 200 feet of hose are to be used, two hosemen may be required to support and move hose. One hoseman stops at approximately one-third the distance to firing position and continues to help pull hose from there while firer and other hoseman proceed forward. Second hoseman stops at approximately two-thirds the distance to firing position and continues to help pull hose while firer proceeds toward firing position.

f. If 100 feet of hose are to be used, only one hoseman is necessary to help support and move hose. He stops approximately halfway from firing position and helps pull the hose at this point while firer moves forward.

g. Keep gun pointed away from friendly personnel at all times.

h. Do not face the front of the gun at any time. Even when fuel is not being ejected, the incendiary charges of the ignition cylinder can cause severe burns.

i. Keep gun dry and clean if possible. Avoid getting dirt or foreign matter into the weapon.

j. Carry extra ignition cylinders only in metal containers.

## 22. Gun firing positions.

a. Ease of aiming. The gun can be fired from any position which permits sufficient freedom to aim the weapon, subject to the conditions in subparagraphs b and c below.

b. Recoil. Stability must be sufficient to withstand the recoil from the gun. When using liquid fuel, the firer, if possible, should hold the gun snugly against his right side to support it and to absorb its recoil. Recoil when firing thickened fuel is much less than when firing liquid fuel.

c. Protection. Full advantage should be taken of cover and concealment, such as shell craters and vegetation. The gun nozzle-end is constructed with a 30-degree angle so the gun often can be fired from a protected angle toward the target opening.

## 23. Ranges.

Firers and assistants should learn to judge ranges by frequent practice under varying conditions. The firers should be trained to approach as close as practicable to the target and to fire if possible at point-blank range for the greatest results. Ranges are less than in the case of ordinary portable flame throwers because of the pressure drop due to friction in the long hose.

a. Point-blank range. (1) Effects. At very close (point-blank) range almost all of the burning fuel can be fired at great velocity directly through ports and openings into the target. Maximum casualties and damage are caused in the hostile position.

(2) Protection. Common sense precautions are taken to prevent casualties to friendly personnel from possible ricochet or rebound of flame. If the target includes a vertical wall at a right angle to the firer or other friendly personnel, the weapon should not be fired at closer than 7 to 10 yards. When the weapon is fired at small openings

in a bunker or pillbox, the firer and other members of the assault squad should not approach closer than 7 to 10 yards from the target.

b. Other effective ranges. (1) Open fields of fire. When thickened fuel is used, this weapon may fire with considerable effect as far as 30 yards under normal conditions, depending on wind direction and wind speed. Under the same conditions, liquid fuel may be effective at 20 yards. Results and accuracy are not as great as at point-blank range.

(2) Jungle or thick underbrush. If the target is located in jungle or thick underbrush without cleared fields of fire, the effective range of the flame thrower is reduced by as much as one-half, depending on the nature and density of the vegetation.

c. Ineffective ranges. Although the flame may reach considerably farther than the ranges stated in subparagraph b (1) above, it may be useless because of the steep angle of descent and because much of the fuel is burned before it reaches the target.

#### 24. Wind deflection.

Wind is an important factor because of the low velocity of the flaming fuel. Wind can lengthen, shorten, or deflect the flame.

a. Head winds. Head winds of more than 5 miles per hour tend to carry heat or even flame back toward the firer. Liquid fuel should not be fired into a head wind of more than 5 miles per hour. The range and accuracy of thickened fuels are reduced by strong head winds.

b. Following winds or very light winds. Best results are obtained under these conditions.

c. Cross winds. When firing at or near maximum range, cross winds deflect, break up, and disperse the flame. They also reduce the range.

#### 25. Aiming.

a. Sighting. There are no sights on the gun because of the short range from which it is fired, the variety of fuels used, and the marked effects of wind.

b. Fortifications. When firing at a fortified position, flame should be directed into openings (gun ports, firing slits, ventilation screens, doorways). Flame inside gives the desired maximum effect.

c. Thickened fuel. Extensive training develops skill in aiming and is particularly important with thickened fuel.

#### 26. Firing.

a. Soaking the target. It may be desirable to soak the target with fuel first and to ignite it afterward. To do this, fire the bursts without operating ignition lever. Then follow with an ignited burst, firer avoiding blasts which may come from any target opening.

b. Ignited firing. (1) Ignition. Depress safety lock lever and squeeze ignition lever (fig. 27) once vigorously. A flash should appear at the front of the gun showing that an incendiary charge of the ignition cylinder has been ignited. If the flash does not appear, pull the ignition lever again, or as often as necessary up to five times, until a flash appears.

(2) Gun valve. Immediately after obtaining ignition, compress the gun valve forcefully to its full stroke (fig. 27) with the right hand. Burning fuel will be propelled from the gun (figs. 28 and 29).

(3) Adjusting fire. Direct flaming fuel at the target. Continue to squeeze the gun valve throughout the burst. When thickened fuel is fired, follow the fuel with eyes to the side of the stream in order to observe and correct aim. (If eyes are directly behind the stream, the flame may obscure the target.)

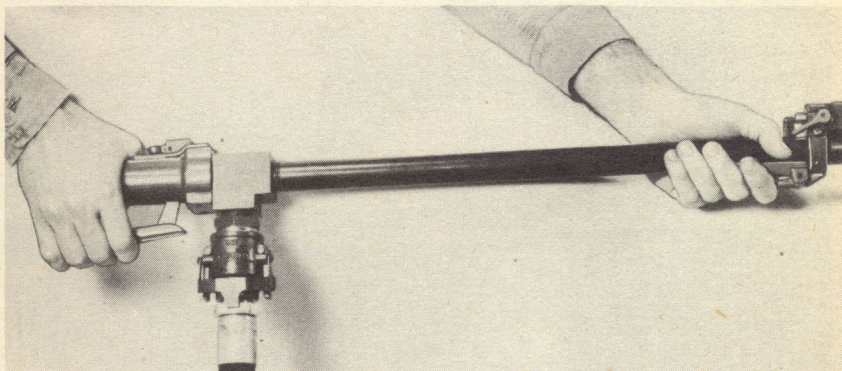


Fig. 27. Firing position of hands.

c. Ceasing or interrupting firing. To cease or interrupt firing, release the controls.

d. Additional bursts. To fire additional bursts, repeat procedure in subparagraph a or b above remembering that there are five incendiary charges in the ignition cylinder. Each charge burns for from 8 to 12 seconds. Additional ignition cylinders may be installed as described in paragraph 20 only after residual flame in ignition shield disappears and ignition head is cool enough to handle.

## **27. After firing.**

When the firer has returned from his mission, he should:

a. Remove and discard the ignition cylinder, as follows:

(1) Point gun at the ground.

(2) Press latch (fig. 23).

(3) Unscrew ignition shield and allow ignition cylinder to fall out. Keep the hands away from the front of the cylinder. [Partly used cylinder may be destroyed by burning (par. 34) or by firing from a gun after gun has been removed from fuel tanks. For information on care, handling, and storage of cylinders, see paragraph 59.]

b. Close the pressure tank valve on M2-2 portable flame thrower tank groups. Close pressure cylinder valves and fuel valves on tank groups (fuel units) of M1A1 portable flame throwers.

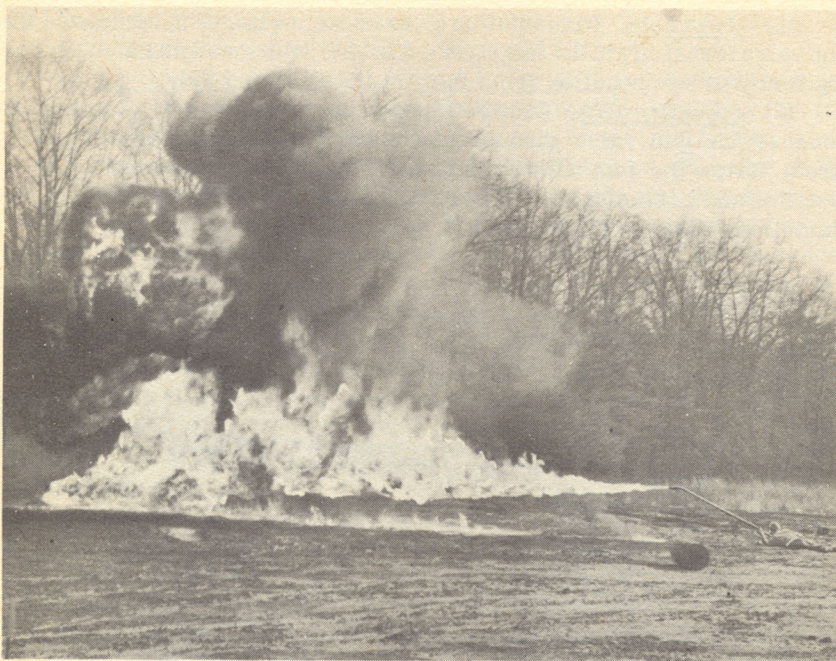


Fig. 28. Firing liquid fuel.



Fig. 29. Firing thickened fuel.

c. Point the gun away from personnel and blow out the remaining fuel from the hose, manifold assembly, and fuel tanks by squeezing the gun valve until there is no further discharge. The ignition lever should not be used during this operation.

d. Inspect, clean, and maintain the equipment (par. 41), or turn the weapon over to experienced maintenance personnel for servicing if they are at hand.

e. After servicing, place the equipment in the packing boxes if available (sec. I, app.) for protected storage, or prepare it for the next mission (par. 39).

### Section VIII. OPERATION OF AUXILIARY EQUIPMENT

#### 28. Packboards.

a. Uses. Two standard quartermaster plywood packboards are supplied with the equipment for carrying the hose. Other packboards may be used to carry the manifold assembly and often provide a simple means of carrying cans of extra fuel and charged pressure tanks or cylinders, along with accessories, tools, and spare parts. Packboards aid in carrying awkward or heavy loads with relative ease, leave the hands free, and hold the load away from the packer's back, protecting it from hard and irregular objects and helping to evaporate perspiration.

b. Loading and carrying. Loads should be well-secured with lashing cord and the load should be carried high on the back.

(1) Lashing. As each article is laid separately on the packboard, the cord should be run across and back, as well as up and down in the hooks, and pulled up very tightly. When the whole load is on the board, fasten the cord with a knot that is easily untied. Run the loose end through the uppermost and lowest cross loops and draw them close together to tighten the lashing.

(2) Quick-release straps. Straps with quick-release buckles may be used instead of lashing cord. These straps, where adaptable to the load, speed up loading and unloading.

### Section IX. OPERATION UNDER UNUSUAL CONDITIONS

#### 29. Wet conditions.

The weapon may be carried and fired successfully in the rain or even after short immersion in water. After use when wet, however, it should be dried to prevent rusting, cleaned, and lubricated. Touch up with fresh paint the areas where paint has worn off. Store the weapon in a dry place. Moisture must not be allowed to enter fuel, ingredients of fuel, or containers of ignition cylinders.

**30. Dust and mud.**

Keep all possible dust, earth, and mud out of the equipment, as particles may interfere with the operation of spring case, valves, bearings, and pressure regulators. If practicable, store weapons and auxiliary equipment in closed chests and boxes when not in use. Clean before use.

**31. Heat.**

A hot climate or exposure to the sun makes the fuel thinner when in containers. Thin fuel has shorter range; it is largely consumed in the air before it reaches usual effective ranges. Where the climate is torrid, less gasoline or other thinning agent should be used in a liquid fuel blend.

**32. Cold.**

Cold weather reduces total heat produced at target but usually not enough to lower seriously the value of a firing mission. Incendiary effects may be decreased because materiel is less flammable when cold. The weapon may be used at temperatures as low as minus 20° F. To improve ignition, use a larger proportion of gasoline in liquid fuel blends.

**33. Wind.**

Flame throwers should not be fired into strong head winds or across strong side winds (par. 24).

**Section X. DEMOLITION  
TO PREVENT ENEMY USE**

**34. Destruction procedure.**

a. When to destroy. If circumstances force abandonment of chemical warfare materiel in the field, destroy materiel to prevent its use or study by the enemy. Such destruction will be undertaken by the using arm only when in the judgment of the military commander concerned such action is deemed necessary and as a final resort to keep the materiel from reaching enemy hands.

b. Technique. Adequate destruction means damaging equipment so that the enemy cannot restore it to usable condition in the combat zone either by repair or by cannibalization.

(1) Guns. Bend or break over a rock, tree trunk, or other hard object. Use ax, sledge, or other heavy instrument to crush or sever parts of guns.

(2) Hose and packboards. Burn, or sever at a number of places with ax, bayonet, or other sharp instrument.

(3) Tanks, cylinders, and manifold assembly. Fire small arms bullets through each of these assemblies to prevent immediate use. If pressure tanks or cylinders are charged and if rounds are to be fired

point blank, open pressure valves permitting contents to dissipate. TNT may be used to achieve total demolition of these assemblies.

(4) Fuel. Burn.

(5) Ignition cylinders. Burn. Personnel should stay several yards from the fire because the cylinders ignite with a slight detonation.

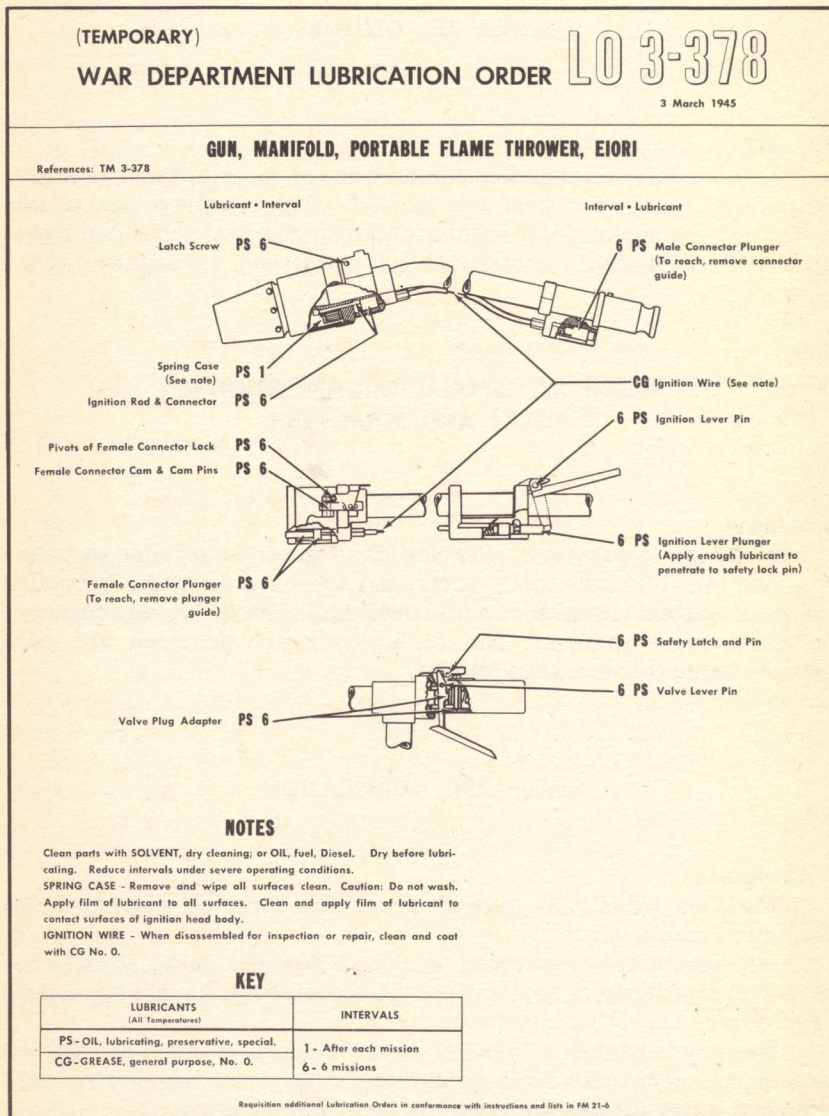


Fig. 30. Tentative Lubrication Order.

**PART THREE****MAINTENANCE INSTRUCTIONS**

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**Section XI. GENERAL****35. Scope.**

Part three contains information for guidance of using organization personnel responsible for first and second echelon maintenance of this equipment. It includes instructions for performance of scheduled lubrication and preventive maintenance services, and descriptions of the major units.

**Section XII. SPECIAL ORGANIZATIONAL  
TOOLS AND EQUIPMENT****36. General.**

No service kit is provided. Service kits for portable flame throwers M2-2 and M1A1 include tools, parts, and accessories useful for maintenance of portable flame thrower manifold E4. A tool kit, an accessory kit, and a spare parts kit (par. 6), however, are provided with each portable flame thrower manifold E4.

**Section XIII. LUBRICATION****37. Lubrication.**

a. WDLO 3-378 (fig. 30, page 27) prescribes first and second echelon lubrication maintenance.

b. Lubricants are prescribed in the KEY on the Lubrication Order along with frequency of application. These intervals should be reduced under severe operating conditions.

c. Use dry cleaning solvent or diesel fuel oil to clean or wash all metal parts. (See note on Lubrication Order regarding spring case assembly.) Dry all parts thoroughly before lubricating.

d. To lubricate ignition wire, fill the palm of the hand with lubricant and run ignition wire through the lubricant.

## Section XIV. PREVENTIVE MAINTENANCE SERVICE

### 38. General.

Preventive maintenance services as prescribed by Army Regulations are a function of using organization echelons of maintenance. These services consist generally of: before operation, during operation, and after operation services performed by the operator or crew; and the scheduled services performed by organizational maintenance personnel.

### 39. Before operation service.

The following services are to be performed before connecting hose to manifold assembly and before loading with ignition cylinder.

#### a. Portable flame throwers.

- (1) Check fuel levels in fuel tanks.
- (2) Be sure all tank groups are filled with the same type of fuel.
- (3) Be sure all pressure tanks (cylinders) are properly charged.
- (4) Check all fittings and couplings to be sure connections can be made to manifold assembly.
- (5) Check all connections for tightness and freedom from leaks.
- (6) Visually check condition of all parts and assemblies for serviceability.

#### b. Manifold fuel hose assembly and manifold assembly.

- (1) Visually inspect all parts for serviceability.
- (2) Check all threaded connections for tightness and freedom from leaks.
- (3) Check all couplings for cleanliness as well as presence and good condition of washers. Close cams and the lock on coupling nipples as well as plugs to test for proper functioning.
- (4) See that there is a coupling plug in each opening of the manifold assembly.
- (5) Be sure hose is coiled evenly and properly secured to packboards for carrying comfort and ease of laying out.

#### c. Manifold gun.

- (1) Visually inspect gun for completeness and good condition of parts and assemblies.
- (2) Check gun connector. Coupling washer must be present and in good condition. Assemble gun and see that connector locks securely.
- (3) Test controls for operation.
- (4) Unscrew ignition shield, and check spring case assembly for ease of rotation on ignition head body. Operate ignition lever to see whether ignition rod moves forward (par. 54) so that its end extends approximately 1/16 inch beyond adjoining lug on ignition head body. Release ignition lever and check whether ignition rod end is flush with

front surface of ignition head body. Adjust ignition system if necessary (pars. 53 and 54).

(5) Check cleanliness of threads on ignition shield and on ignition head body. If not clean, wipe off with cloth. When reassembling, shield should turn freely until it locks in correct position.

(6) Use screw driver to check all screws for tightness. Be sure lock washers are present.

(7) Check gun valve, using wrench, to see that it is screwed tightly on gun. Check tightness of coupling nipple, using wrench, to be sure it is tight on gun valve. Nipple should be clean and not badly burred.

#### 40. Service when firing.

a. If ignition cylinder does not rotate after first ignited burst, as shown by failure to obtain ignition when ignition lever is pulled, strike ignition head lightly against some hard object, such as a tree, to jar ignition cylinder loose.

b. If it is necessary to replace an ignition cylinder during operation, any flame which persists within ignition shield must be extinguished first. The ignition shield becomes very hot during firing and care should be taken not to burn hands. Gloves may be used, or mud or leaves may be applied to outside of shield to permit handling of shield when hot.

#### 41. Service after firing.

a. Ignition cylinder. Remove ignition cylinder, and discard (par. 27).

b. Dismantling apparatus. After completion of firing, dismantle as follows:

(1) If all fuel has been discharged, close valves of pressure tanks or pressure cylinders. Open gun valve to relieve all pressure in gun, hose, manifold, and fuel tanks. Uncouple equipment. Place hose securely on packboards. Replace coupling plugs in couplings.

(2) If fuel has not been completely expended, procedure depends upon whether tank groups are from M1A1, mechanized flame throwers, or M2-2.

(a) For M1A1 portable flame thrower tank groups or mechanized flame thrower fuel groups, close fuel valves on fuel tanks and open manifold gun valve to relieve pressure in the system. Proceed as in subparagraph (1) above.

(b) For M2-2 portable flame thrower tank groups, either open the manifold gun valve to discharge all fuel and to relieve pressure or, using wrench, slightly open filling plug on top of each tank group to relieve pressure. Then disconnect equipment taking care to use coupling plugs or portable flame thrower guns to close off openings and prevent undue amount of fuel spillage. On return from mission, blow out remaining fuel from manifold fuel hose.

c. Cleaning and lubrication. After operation and return from mission, clean all equipment, lubricate (par. 37), and repeat before operation service (par. 39). Do not wash spring case assembly -- clean it by wiping.

## Section XV. TROUBLE SHOOTING

## 42. Foaming of fuel stream.

<u>Trouble</u>	<u>Remedy</u>
"Gassy" or frothy fuel when firing due to unequal pressures in fuel tanks.	Adjust pressure regulators of flame throwers until the pressure in fuel tanks of all the flame throwers is approximately the same.

## 43. Short range.

<u>Trouble</u>	<u>Remedy</u>
a. Stream of burning fuel issues at an angle or in a very broad spray.	Examine nozzle for clogging or damage. Clean or replace parts.
b. Rapid drop of range during burst.	Pressure tank or pressure cylinder valves are not fully open. Open all the way. If this is not effective, test pressure regulators.
c. Shorter range in each successive burst.	Pressure tanks or cylinders are not fully charged. (1) Before firing be sure pressure tanks or cylinders are charged to at least 1,800 pounds per square inch. (2) Check for leaks to make sure pressure has not decreased since charging. Use pressure gage if available.
d. Short range with longer time of discharge than usual.	Dried fuel or other foreign matter is in fuel lines. Disassemble and clean.

## 44. Fuel leaks.

<u>Trouble</u>	<u>Remedy</u>
a. Worn or damaged hose.	Replace worn or damaged portion of hose (par. 51).

<u>Trouble</u>	<u>Remedy</u>
b. Leak at coupling or gun connector.	Examine coupling washer. Replace if damaged or worn. If coupling plug or nipple is damaged or worn, repair or replace.
c. Leaks at silver-brazed joints of manifold assembly.	Return manifold assembly to higher echelon for repair, and install a replacement manifold assembly.
d. Leak at gun valve or nozzle.	Replace gun valve.

**45. Failure of fuel to ignite.**

<u>Trouble</u>	<u>Remedy</u>
a. Fuel troubles at low temperature.	At temperatures above minus 20° F., no difficulty should be experienced with ignition of fuel. When blended liquid fuels are used, the ratio of gasoline content should be increased as temperature decreases.
b. Failure of ignition cylinder.	See paragraph 46.

**46. Failure of ignition cylinder to ignite.**

<u>Trouble</u>	<u>Remedy</u>
a. Ignition lever does not operate.	Move safety lock lever into safe position with finger pressure. If this does not correct condition, ignition wire probably binds in its tube. This may be caused by dirt, lack of lubricant, or kinking of tube or wire. Disassemble, clean, lubricate, and repair or replace defective parts.
b. Match in ignition cylinder moves but incendiary charge does not ignite.	Pull ignition lever repeatedly. If an incendiary charge does not ignite, remove cylinder and examine: (1) If matches have been pushed flush with inner surface of cylinder body, the cylinder is defective. Destroy (par. 34).

<u>Trouble</u>	<u>Remedy</u>
c. Cylinder does not rotate to bring new charge into position.	(2) If matches project 1/16 inch or more from cylinder, ignition head is defective. Disassemble ignition head (par. 54) and examine. Replace parts as necessary.
d. Ignition rod does not transmit push to ignition cylinder.	Failure to rotate may be caused by: (1) Spring case not free to rotate because of dirt. Clean and lubricate (par. 37). (2) Improperly loaded cylinder. Reload (par. 20). (3) Binding of ignition cylinder on gun because of dirt or excessive warping of ignition cylinders from heat of firing. Remove and destroy ignition cylinder (par. 34). (4) Defective spring case. Replace with new spring case.
	Ignition wire is loose. Tighten set screws (par. 53).

**47. Fuel tanks fail to empty.**

<u>Trouble</u>	<u>Remedy</u>
Insufficient pressure.	Be sure pressure tanks or cylinders are fully charged. Check for possible leaks. If fully charged and leaks are not present, examine swing check valve in manifold assembly adjacent to fuel tanks for condition of parts and possible need for re-grinding (par. 50).

**48. Fuel backs up into pressure system.**

<u>Trouble</u>	<u>Remedy</u>
a. Swing check valve failure.	Examine the swing check valve adjacent to tank group involved. Regrind if necessary (par. 50).
b. Pressure regulator failure.	Service or replace regulator.

## Section XVI. MANIFOLD ASSEMBLY AND HOSE

### 49. General.

The manifold assembly and the manifold fuel hose assembly serve to link manifold portable flame thrower gun E10R1 with the fuel hose and tank groups (fuel units) of M2-2 or M1A1 portable flame throwers.

### 50. Manifold assembly.

a. General. The manifold assembly is a device for connecting the fuel tanks and hose of as many as six portable flame throwers to a single outlet (manifold fuel hose assembly). The manifold assembly consists of the following:

(1) Manifold body. The body includes two bronze crosses and one bronze tee which are silver brazed to short nipples and thence to six bronze swing check valves (fig. 31). The central cross is connected to the outer cross and the tee by two silver-brazed nipples. Nipples, with 3/4-inch N.P.T. thread outlets, are silver brazed to each of the six check valves and to the six outlets of the crosses and tee. An additional nipple, with 3/4-inch N.P.T. threaded outlet, is silver brazed to the remaining outlet of one of the crosses. All nipples are made of 3/4-inch extra strong brass pipe.

(2) Couplings. Seven couplings are screwed on the outlets of the manifold body (fig. 31). The couplings are interchangeable with the coupling on the manifold fuel hose assembly and with those on tank groups of M2-2 portable flame throwers. These couplings are quick-connecting and provide a pressure tight and liquid tight seal if in proper condition.

(3) Coupling plugs. Seven coupling plugs are provided. Each plug closes off an outlet of the manifold assembly when it is not desired to connect a hose to the outlet. The plugs are interchangeable with the coupling plugs furnished with M2-2 portable flame throwers.

b. Removal. (1) Coupling plugs or hose assemblies may be removed from couplings by opening couplings (par. 12).

(2) Couplings may be unscrewed from the manifold body by applying a wrench to the coupling body.

(3) Coupling washers may be removed by prying from coupling body with screw driver.

(4) In an emergency, cams and locks may be removed from coupling body by driving out straight pin with hammer and drift, after filing peened head from end of pin.

(5) The manifold body must not be disassembled at silver-brazed connections except by third or higher echelon personnel skilled in the technique of silver brazing.

c. Installation. (1) A coupling washer is installed by inserting it into the undercut in the coupling body.

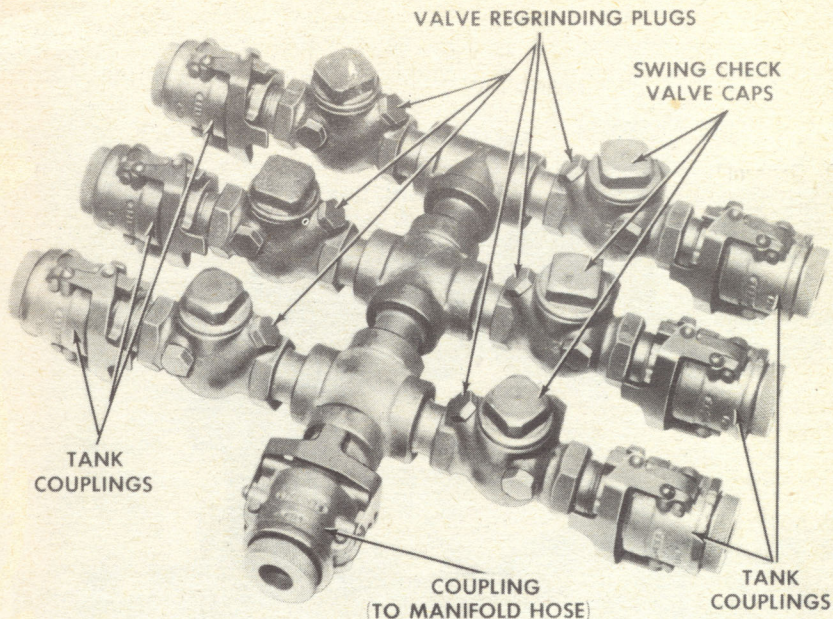


Fig. 31. Manifold assembly.

(2) Coupling cams and locks may be installed by placing them in position on coupling body and driving straight pin through the holes with hammer. Use hammer to peen end of pin after pin has been assembled into body.

(3) Before screwing couplings on the manifold body, apply a light coating of aluminum thread lubricant, which is supplied in the spare parts kit with the equipment, to the threads. Tighten couplings with wrenches.

(4) Coupling plugs or hose assemblies are locked in coupling bodies by closing the cams and locks (par. 12).

d. Maintenance. (1) Defective coupling washer. If synthetic rubber coupling washer is swollen or damaged, causing possible leaks at the joint, remove washer and install new one.

(2) Looseness in coupling. If a coupling does not lock tightly on hose or on coupling plug, examine cams, lock, and body for damaged or defective parts. Install new parts as needed.

(3) Leak between coupling and manifold body. If leak occurs between coupling and manifold body, remove coupling, apply fresh light coat of aluminum thread lubricant (which comes in spare parts kit with equipment), and reinstall. If leak persists, replace coupling body or coupling.

(4) Silver-brazed joints. If leaks occur at silver-brazed joints in manifold body, remove couplings from manifold body. Install couplings

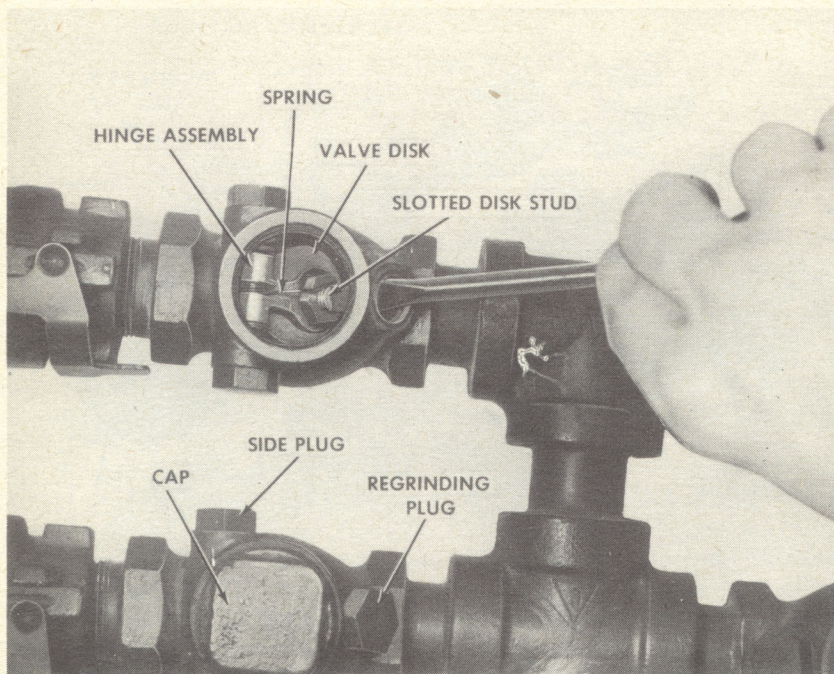


Fig. 32. Regrinding a swing check valve.

on new manifold body and return used manifold body to higher echelon for repair.

(5) Swing check valve. Swing check valve may leak, causing fuel to back up into the pressure system or preventing full discharge of the fuel. If so, it may be reground without removal from the manifold assembly and without need for special tools. Procedure is as follows:

(a) Using a wrench, unscrew and remove the large hexagonal cap on top of valve (fig. 32). Do not remove until certain the manifold assembly is not under pressure.

(b) Wipe interior of valve clean of any foreign matter, using clean cloth and dry cleaning solvent if necessary.

(c) Using a wrench, unscrew square-headed regrinding plug from top of downstream end of valve body.

(d) Using wrench, unscrew plug from side of valve body, and withdraw hinge pin. Lift out disk, spring and hinge assembly.

(e) Apply valve grinding compound to disk. If both coarse and fine grades of compound are available, apply coarse grade first.

(f) Place disk, hinge assembly, and hinge pin in their normal positions in valve.

(g) Insert screw driver in slotted end of disk stud, and turn screw driver to rotate disk approximately one-quarter turn. Rotate clockwise and counterclockwise to grind disk in seat. Lift disk from seat and set

disk in a new position on seat. Add additional grinding compound if necessary. Rotate disk clockwise and counterclockwise to grind new area. Continue turning and grinding disk until entire surface of seat and disk have been ground together.

(h) If coarse valve grinding compound has been used and fine valve grinding compound is available, repeat procedures in subparagraphs (d) through (g) above, using fine valve grinding compound.

(i) Using dry cleaning solvent and clean cloth, flush and remove all traces of grinding compound from the valve and surrounding parts.

(j) Place disk and hinge assembly, with spring and hinge pin in their positions, in valve body.

(k) Using wrench to tighten, screw both plugs and hexagonal cap in position in valve body.

(l) Connect manifold assembly to filled and charged tank group (fuel unit) of portable flame thrower, and release fuel under pressure through check valve to test for leaks. If leaks occur, more grinding may be required. Retest, and if failure occurs again it may be necessary to install new manifold assembly.

#### **51. Manifold fuel hose assembly.**

a. General. Manifold fuel hose assembly provides a flexible connection between the manifold assembly and the manifold gun. Two hose assemblies are provided with each gun and manifold. When connected, they make possible the flow of fuel under pressure to the gun at distances of up to 200 feet from the manifold assembly. Each of the two hose assemblies is 100 feet long and consists of:

(1) Hose. Made of synthetic rubber and reinforced with a cover of metal wire and cotton braid, the hose resists the action of gasoline and oil. It withstands abrasion and internal pressure of approximately 1,000 pounds per square inch. Inside diameter is 7/8 inch and outside diameter is approximately 1-1/4 inches. The hose is provided in a maximum of four lengths totalling 100 feet, with the lengths joined by 3/4-inch iron pipe couplings (fig. 33).

(2) Couplings. A coupling nipple screwed on one end of the 100-foot hose fits into and may be locked in the end tank coupling of the manifold assembly. A tank coupling screwed onto the other end of the hose connects the 100-foot hose to a second 100-foot hose or to the manifold gun.

b. Removal. (1) To remove hose assembly from the gun, the manifold assembly, or a second hose assembly (par. 12), uncouple.

(2) To remove the coupling from the hose, unscrew, applying wrenches to coupling body and hexagonal portion of hose nipple.

(3) To remove coupling nipple, apply wrenches to hexagonal portion of nipple and hexagonal end of hose.

(4) To separate lengths of hose, apply wrenches to hexagonal ends of hose adjacent to 3/4-inch iron pipe coupling.

(5) To disassemble quick-connecting tank coupling, follow procedure in paragraph 50.

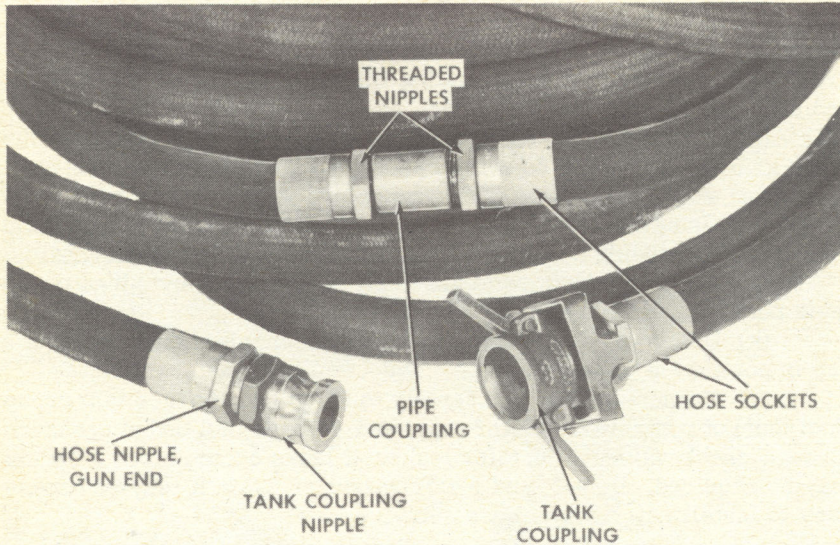


Fig. 33. Manifold fuel hose connections.

c. Installation. (1) To couple hose assembly to gun, to manifold assembly, or to a second hose assembly, close cams and lock the coupling.

(2) To connect quick-connecting coupling to hose, lightly apply aluminum thread lubricant (which comes in spare parts kit) to threads, screw in position, and tighten with wrenches.

(3) To connect coupling nipple to end of hose, screw nipple into hose, and tighten by applying wrenches to hexagonal portion of nipple and hexagonal end of hose.

(4) To connect separate lengths of hose, apply white lead, aluminum thread lubricant, or equal, to threaded ends and screw into iron pipe coupling. Tighten, applying wrenches to hexagonal ends of each hose.

(5) To assemble quick-connecting coupling, follow procedure in paragraph 50.

d. Maintenance. (1) If leaks occur at threaded joints, disconnect parts, clean threads, apply fresh luting compound, such as aluminum thread lubricant from spare parts kit, and reconnect. If leaks persist, install new parts.

(2) If a leak occurs between gun and coupling on hose assembly, examine washer in coupling for swelling or damage. If washer is defective, install new washer. If a cam, lock, or coupling body is damaged, install new part by driving pin through cam, lock, and body. If the coupling nipple which fits into the coupling is badly nicked and does not provide a tight connection with a new coupling washer, file the end surface of the nipple, being careful to keep the surface at right angles to the sides of the nipple. Connect the nipple and coupling. If coupling

closes too freely indicating washer is not being compressed, install new washer. If coupling still closes too freely, the nipple has been filed too short and the part must be replaced.

(3) If hose is punctured or badly worn in small areas, it should be returned to higher echelon for repair. Disconnect length of hose involved. In an emergency, hose may be repaired as follows:

(a) Place metal socket (on end of hose) in a vise, using shaped wooden blocks if socket is cylindrical, or insert directly in vise if socket is hexagonal.

(b) Using wrench on hexagonal portion of 3/4-inch threaded nipple adjacent to socket, unscrew nipple from hose and socket.

(c) Pull socket from hose, using twisting action.

(d) Cut off damaged portion of hose, being sure hose end is cut clean and square.

(e) Replace socket over cut end of hose, pushing socket as far as it will go.

(f) Wet the tapered end of 3/4-inch threaded nipple and interior of hose with glycerine, hydraulic brake fluid, soap and water, or plain water.

(g) Screw 3/4-inch threaded nipple into socket.

(h) Make connection tight with wrench.

## **Section XVII. GUN, MANIFOLD, PORTABLE FLAME THROWER, E10R1**

### **52. General.**

One portable flame thrower manifold gun E10R1 is included as part of each portable flame thrower manifold E4.

### **53. Gun control-end.**

a. General. The gun control-end is the rear half of the gun. It connects the manifold fuel hose assembly with the gun nozzle-end, or forward half of the gun. The control-end supports the controls of the gun and also serves as a passage for fuel to the nozzle. The control-end includes:

(1) Control-end fuel pipe. This pipe, through which fuel flows when the weapon is operated, is made of 3/4-inch seamless aluminum alloy tubing, threaded at both ends. A length of 3/16-inch outside diameter aluminum alloy tubing is attached by clamp rings to the 3/4-inch tubing and serves as a conduit for the ignition wire which is 0.056 inch in diameter.

(2) Gun valve. This valve, which controls the flow of fuel, is screwed on the rear end of the gun.

(3) Ignition lever assembly. This assembly is mounted on the control-end fuel pipe between the gun valve and the gun connector.

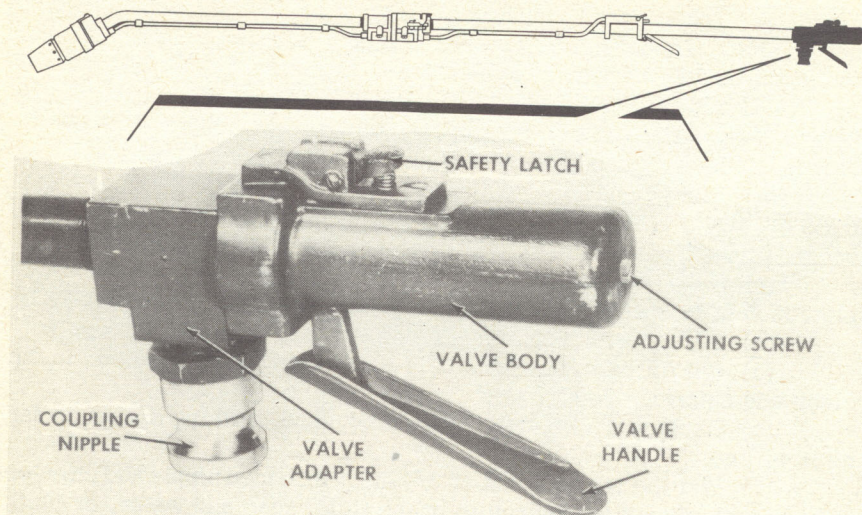


Fig. 34. Butt of gun showing gun valve.

(4) Gun connector. The control-end gun connector fits over the nozzle-end gun connector and serves to connect the two halves of the gun.

b. Disassembly of gun control-end. (1) Gun valve. Apply wrench to square portion of valve (fig. 34) and unscrew from fuel pipe. Coupling nipple may be unscrewed from valve body with a wrench.

(2) Ignition lever assembly. (a) Unscrew ignition lever pin. Remove pin and lever (figs. 35 and 36).

(b) Using hammer and drift or nail, drive lock pin from safety lock lever. Remove lever from pin.

(c) Unscrew two screws from lever plunger guide. Remove guide. Be careful not to lose lock washers.

(d) Loosen set screws in ignition lever plunger to free ignition wire.

(3) Female gun connector. (a) Using wrench, unscrew bushing from female gun connector (figs. 37 and 38).

(b) Using screw driver, remove screws and lock washers which hold connector guide to body of connector. Lift out connector guide.

(c) Using socket head set screw wrench, loosen the two set screws which hold connector plunger to ignition wire. Follow procedure in subparagraph (2)(d) above to free back end of ignition wire.

(d) Slide connector plunger forward to clear end of ignition wire. Push end of ignition wire clear of ignition plunger and female gun connector. Pull ignition wire clear of gun connector.

(e) Apply large wrench to body of gun connector and unscrew from fuel pipe.

(f) Washer, lock, and cams may be removed in manner similar to those on couplings.

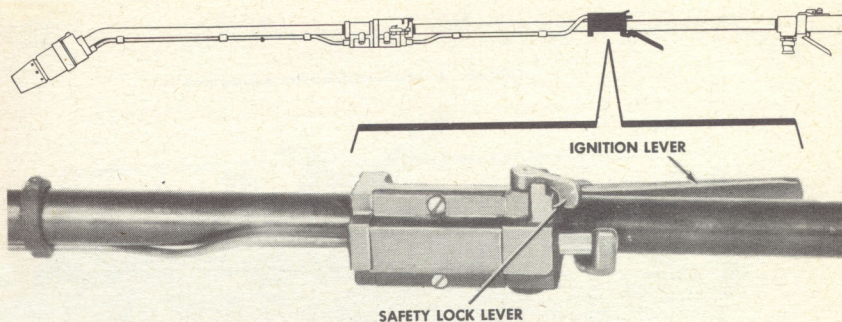


Fig. 35. Ignition controls.

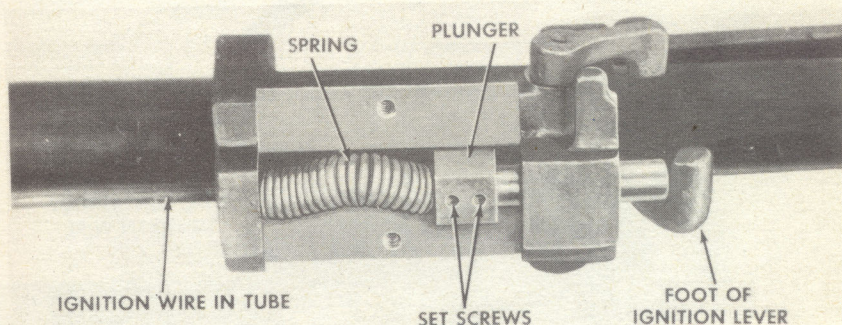


Fig. 36. Ignition controls (partly disassembled).

(4) Tubing holding ignition wire. Loosen set screws in tube clamps and slide tubing out from clamps.

c. Assembly of gun control-end. Reverse procedures in subparagraph b above, taking care not to kink ignition wire or tubing which holds this wire. Be sure to lubricate before assembling (par. 37). Place lock washers under screws before installing.

d. Adjustment of gun control-end. (1) Gun valve. This valve (fig. 34) rarely requires adjustment. If a leak develops, try to correct by increasing tension of spring in valve by turning adjusting screw at butt end of gun clockwise approximately one-eighth of a turn, or more as needed. If this does not stop leak or if increased tension makes valve too difficult to operate, remove valve and install new valve. Old valve may be reground in higher echelon.

(2) Ignition lever. The foot of the ignition lever should have not more than approximately 3/16-inch play before it touches ignition lever plunger. If play is greater, remove ignition lever and bend foot of the lever slightly forward to reduce the gap. Reinstall ignition lever.

(3) Ignition wire. (a) Remove the four plunger covers from ignition head, gun connectors, and ignition lever assembly of assembled gun (both halves connected).

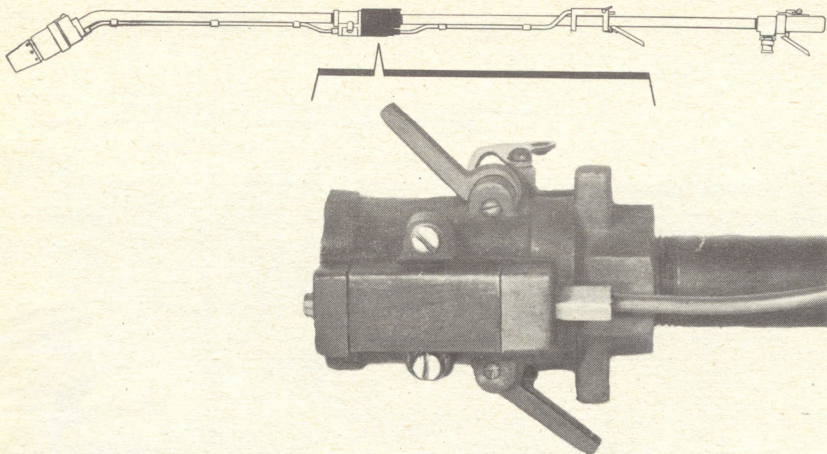


Fig. 37. Female gun connector.

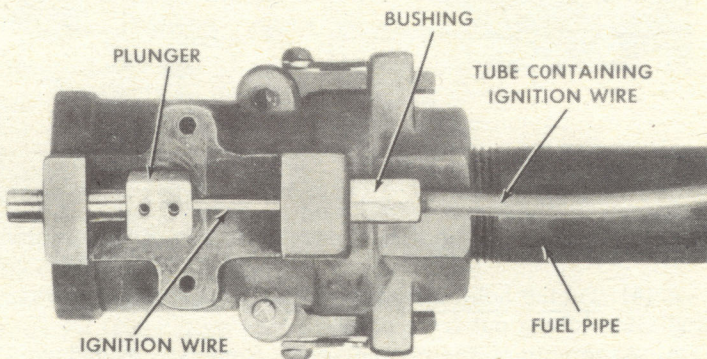


Fig. 38. Female gun connector (partly disassembled).

(b) Loosen eight set screws (two on each plunger) which hold ignition wire.

(c) See that ends of ignition wires (of both halves of gun) are in holes in plungers.

(d) Start adjustment on butt end of gun by grasping wire with pliers where wire is exposed behind female connector plunger. Push ignition wire back toward butt of gun as far as it will go. Tighten two set screws in ignition lever plunger.

(e) Slide the female connector plunger forward toward nozzle by hand until it touches the male connector plunger. Tighten two set screws in female connector plunger.

(f) Depress ignition lever to push the ignition rod connector (plunger) and ignition rod forward.

(g) Two men are required for this operation. With ignition lever

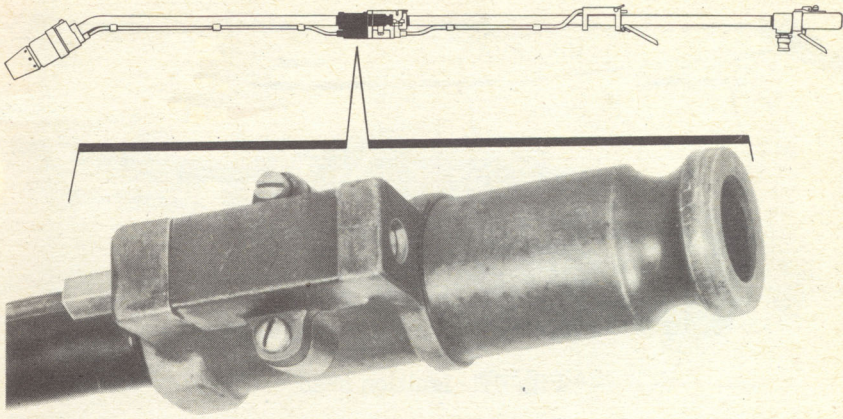


Fig. 39. Male gun connector.

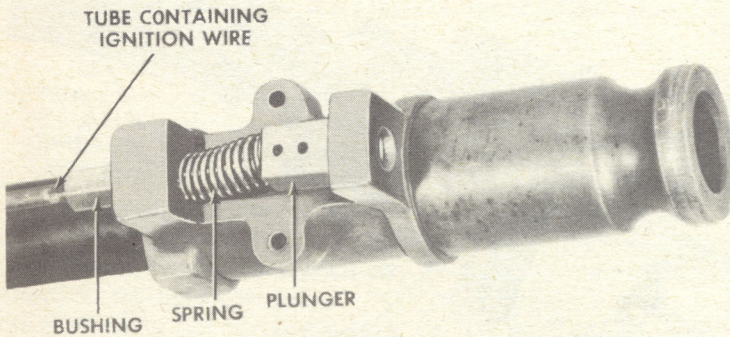


Fig. 40. Male gun connector (partly disassembled).

depressed and using pliers, grasp ignition wire where it is exposed behind connector in ignition head, and push wire back toward butt as far as it will go. Tighten the two set screws in male connector plunger. Release ignition lever.

(h) Push ignition rod and connector forward until the forward end of rod is flush with end surface of ignition head body. Tighten two set screws in connector.

(i) Lubricate parts (par. 37), and replace the four plunger covers.

#### 54. Gun nozzle-end.

a. General. The gun nozzle-end is the front half of the gun. It serves as a passage for fuel from the gun control-end and includes the nozzle and ignition head of the gun. The nozzle-end includes:

(1) Gun connector. The male gun connector (figs. 39 and 40) fits into the control-end gun connector and serves to connect the two halves of the gun.

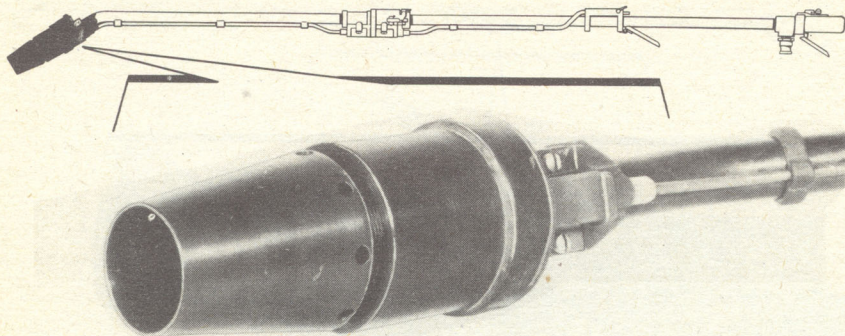
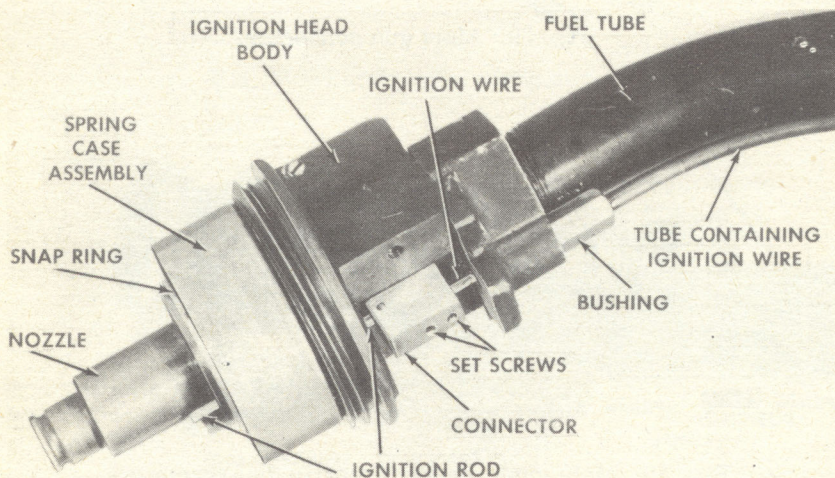


Fig. 41. Ignition head.

Fig. 42. Ignition head, partly disassembled  
(ignition rod pushed fully forward).

(2) Nozzle-end fuel pipe. This pipe, through which fuel flows when the weapon is operated, is made of 3/4-inch seamless aluminum alloy tubing, threaded at both ends. A length of 3/16-inch outside diameter aluminum alloy tubing is clamped to the 3/4-inch tubing and serves as a conduit for the ignition wire. The nozzle-end fuel pipe is bent at a 30-degree angle at the front end to permit the firer to approach the target and fire from a protected angle.

(3) Ignition wire. A 46-inch length of spring-tempered, corrosion resisting steel wire, 0.056 inch in diameter, transmits forward pressure from the control-end to the ignition head when the ignition lever is operated. The ignition wire is housed in the 3/16-inch tubing of the fuel pipe. The 3/16-inch tubing is connected to the ignition head body and male connector by threaded bushings.

(4) Ignition head. The ignition head (figs. 41-43) is mounted on the

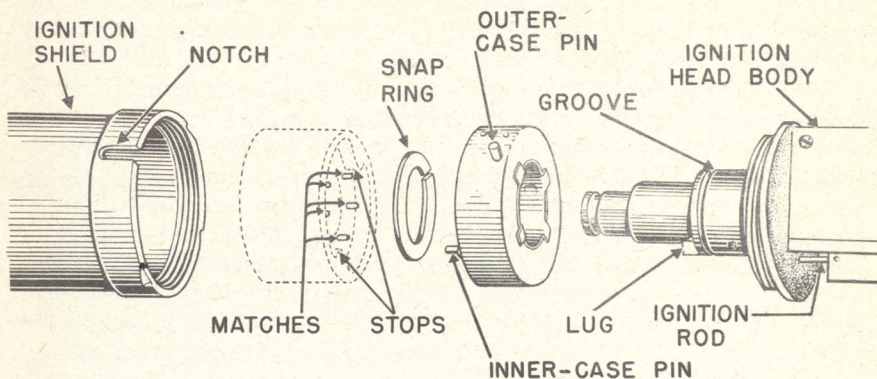


Fig. 43. Parts of ignition head and ignition cylinder.

front end of the nozzle-end fuel pipe. It ignites the fuel when loaded with igniter cylinder and when ignition lever is operated. The ignition head includes:

(a) Ignition head body. This aluminum alloy part is screwed onto the front end of the fuel pipe. It serves as a passageway for fuel to the nozzle and supports other portions of the ignition head.

(b) Nozzle. The nozzle is press-fitted in the ignition head body. It is an aluminum alloy part with an internal taper. Flame thrower fuel is ejected from the nozzle through the ignition shield.

(c) Ignition shield. This metal tube, which is screwed on the front end of the ignition head body, guides the flame and protects the firer. Eight holes around the base of the shield provide an air intake for ignition of the fuel. A slot in the base of the shield receives the latch and the outer-case pin of the spring case.

(d) Latch. This metal part is held on the ignition head body by a latch screw. The end of the latch fits in the ignition shield slot and holds the shield on the ignition head body. Pressure on the knurled end of the latch compresses the latch spring and permits unscrewing of the shield from the body.

(e) Bushings. The bushings are metal tubes, hexagonal at one end and threaded at the other. They support the ignition wire and tubing.

(f) Ignition rod connector. This steel block is the connecting link between the ignition wire and the ignition rod. The ignition wire is held in the rear of the connector by means of two socket head set screws. The ignition rod is held in the front of the connector by means of a straight steel pin. The connector is held on the ignition head body by the ignition rod connector guide.

(g) Ignition rod. When the ignition rod is pushed forward it pushes one of the metal matches in the ignition cylinder which ignites one of the incendiary charges in the ignition cylinder.

(h) Spring case assembly. When firing, the spring case assembly automatically rotates the ignition cylinder one-fifth of a revolution

as soon as one of the five metal matches in the ignition cylinder is pressed in by the ignition rod. This makes another incendiary charge immediately available for use.

1. Four projections on the inner-case spring are bent over the outer-case spring to hold the two parts together.

2. The inner-case pin engages a stop on the inside of the ignition cylinder. The five projecting metal matches on the inside of the ignition cylinder are each in turn stopped by the lug on the forward surface of the ignition head body. The spring in the case rotates the ignition cylinder until another match is stopped by the lug.

3. The outer-case pin (on the outside surface of the outer-case spring) fits into the slot in the ignition shield and holds the spring case as the shield is screwed into position. This action winds the spring in the case.

(i) Snap ring. A split steel snap ring holds the spring case in position on the ignition head body.

b. Disassembly of gun nozzle-end. (1) Uncouple the two halves of the gun at the gun connector.

(2) Unscrew ignition shield by pressing latch and turning shield counterclockwise. If an ignition cylinder is in ignition head, keep face and hands away from front of shield.

(3) If ignition cylinder is in ignition head, remove it or allow it to fall to ground. Keep hands from front of cylinder and do not force in any of the metal matches in the ignition cylinder.

(4) Pry off snap ring which holds spring case assembly in position, using screw driver. Be careful not to damage or break the ignition head body by applying too much leverage. Slide spring case assembly off gun from front of nozzle. Do not disassemble spring case assembly.

(5) Unscrew latch screw with screw driver. Lift out latch and latch spring.

(6) Using screw driver, unscrew two screws and lock washer which hold ignition rod connector guide on ignition head body. Lift out connector guide.

(7) Using socket head wrench, loosen the two set screws which hold ignition wire in ignition rod connector.

(8) With a nail or other small tool, push the pin out of the ignition rod connector. Remove the ignition rod from the front of the ignition head body.

(9) Remove ignition wire as described in paragraph 53b(14)-(16).

(10) Using adjustable wrench, unscrew and remove bushing from ignition head body.

(11) Using large wrench, unscrew ignition head body from fuel pipe. Subparagraphs (1) through (5) may be omitted if it is desirable to remove entire ignition head as a unit. Do not attempt to remove nozzle from ignition body as the two parts are held together by a press fit.

(12) Unscrew bushing from male gun connector, using adjustable end wrench.

(13) Using screw driver, remove screws and lock washers from

connector guide and withdraw connector guide from gun connector.

(14) Using socket head wrench, unscrew the two set screws which hold ignition wire in male connector plunger.

(15) Using screw driver, push male connector plunger toward nozzle-end until end of plunger clears hole in male gun connector. Lift plunger up and remove.

(16) Using pliers, pull ignition wire out through hole in end of male gun connector.

(17) Remove ignition rod connector from ignition head body.

(18) Using large wrench, unscrew gun connector from fuel pipe.

c. Assembly of gun nozzle-end. (1) Screw male gun connector on end of fuel pipe, using a small quantity of aluminum thread lubricant (from spare parts kit) on pipe threads. Tighten with wrench so that bottom of gun connector is alined with downward bend at front end of fuel pipe.

(2) Place spring over end of male connector plunger. Insert 3/16-inch tubing through bushing. Apply aluminum thread lubricant to threads, and, using wrench, tighten bushing in gun connector.

(3) Lubricate and insert ignition wire in 3/16-inch tube. This is most easily done by feeding the wire through the hole in the rear of the male gun connector.

(4) Push forward end of wire into ignition rod hole in ignition head body. Lift up rear end of wire from male gun connector. Put spring over wire, insert end of wire into hole in male connector plunger, and put male connector plunger in male gun connector.

(5) Put ignition rod connector over nozzle end of ignition wire, and replace ignition rod connector in ignition head body.

(6) Insert ignition rod through ignition head body and into ignition connector.

(7) Insert pin in ignition rod connector.

(8) Adjust ignition wire as described in paragraph 53.

(9) Replace connector guide and male connector plunger guide, making sure a lock washer is underneath each screw.

(10) Place latch and latch spring on top of ignition head body. Spring should fit over pin under the latch and should also fit into small recess in ignition head body directly under the latch. Apply aluminum thread lubricant to latch screw. Insert screw through holes in body and in latch. Tighten with screw driver.

(11) Lubricate ignition head body (par. 37). Place spring case assembly in position on body. Lock spring case assembly by pushing snap ring into groove at front of ignition head body.

(12) Screw ignition shield in place (par. 20).

d. Adjustment of gun nozzle-end. Adjustment of ignition wire is described in paragraph 53d.

e. Maintenance of gun nozzle-end. (1) Servicing. Clean and lubricate ignition head (par. 37) each time it is disassembled.

(2) Spring case assembly. If outer case rotates and inner case does not, and no spring action occurs, spring is broken and spring case

assembly should be replaced as a unit. Do not disassemble or repair spring case assembly.

(3) Ignition rod. When ignition lever is fully depressed, end of ignition rod should extend approximately  $1/16$  inch beyond lug on forward surface of ignition head body. If ignition wire has been adjusted (par. 53d) and proper motion of ignition rod is still not obtained, it may be necessary to replace ignition rod. Lug on ignition head body should be approximately  $7/32$  inch high. If lug is worn or broken, replace ignition head body.

## PART FOUR

# AUXILIARY EQUIPMENT

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### Section XVIII. GENERAL

#### 55. Scope.

Part four contains information to guide personnel responsible for operation of this equipment. It contains only the information necessary for using personnel to identify, connect, and protect auxiliary equipment while being used or transported with the main equipment. Detailed information on auxiliary equipment will be found in other publications. See appendix for list of references.

### Section XIX. AMMUNITION

#### 56. General.

Ammunition for the weapon may be said to consist of flame thrower fuel, compressed air or compressed nitrogen, and ignition cylinders. Fuel may be considered as the projectile, compressed air or nitrogen as the propelling charge, and the ignition cylinder as the igniter. Each of these components is supplied separately. The portable flame thrower fuel tanks are filled with fuel, and the pressure tanks (pressure cylinders) are charged with air or nitrogen before the start of a mission. Compressed air or nitrogen is released into the fuel tanks and an ignition cylinder is loaded in the gun just prior to firing.

#### 57. Flame thrower fuels.

Thickened fuels give greater range than liquid fuels. The stream of thickened fuel is comparatively narrow. Most of the glue-like fuel clings to and burns in or on the target for as long as 6 minutes. Liquid fuels, on the other hand, are largely consumed in flight to the target. If the location of small openings in the target is known, the stream of thickened fuel can be spotted by accurate aiming so that most of the fuel enters directly into the openings. Although it does not billow around corners as does liquid fuel, thickened fuel strikes the target with force enough to ricochet inside. It clings to skin and clothing while burning. It also has excellent incendiary effects. The initial flame and smoke are less from thickened fuel than from liquid fuel, but the lower visibility, greater range, and much longer burning period of thickened fuel compensate for its smaller screening effect. Liquid fuels are easier to pour when filling than are thickened fuels. Only pourable thickened fuels should be used.

**58. Compressed air or nitrogen.**

All pressure tanks or pressure cylinders of the portable flame thrower tank groups (fuel units) must be fully charged before they are connected to the manifold assembly.

a. Pressure required in pressure tanks of portable flame throwers is approximately 1,800 to 2,000 pounds per square inch.

b. After filling fuel tanks with fuel, pressure regulators of all tank groups (fuel units) to be used with a manifold should be tested with a pressure gage for uniformity of outlet pressure (350 to 390 pounds per square inch) in fuel tanks.

c. Pressure cylinders and pressure tanks are charged with air or nitrogen by use of either an air compressor of suitable capacity (TM 3-377) or large cylinders containing compressed air or nitrogen (TM 3-376A and TM 3-375). Precautions described in Technical Manuals accompanying equipment must be followed.

**59. Ignition cylinders.**

a. Description and functioning. The M1 ignition cylinder is used (figs. 22 and 44). The cylinder fits over the forward part of the gun and is revolved by the spring case. The five incendiary charges in the cylinder are spaced sufficiently far apart in the plastic body to prevent their igniting one another. Lead-foil seals, plastic closure plates, and waterproof cement make the unit waterproof.

b. Action. When the ignition rod is pushed forward, one of five metal matches tipped with red phosphorus scratches an igniting mixture. This ignites a starter mix and a few grains of black powder or fulminate on top of the incendiary charge. The black powder blows the foil seal and closure plate clear of the gun; the incendiary charge ignites the fuel as it is discharged from the nozzle. Each of the five incendiary charges burns for from 8 to 12 seconds.

c. Packing. Ignition cylinders are packed two per waterproof can. Three cans are furnished with each flame thrower. Fifty cans (100 ignition cylinders) are contained in each packing box of extra cylinders.

d. Care, handling, and storage. Ignition cylinders contain hazardous incendiary material and must be handled with care. The following precautions should be observed.

(1) Opening cans. Do not open cans containing cylinders until ready to load for a mission (par. 20). If an extra cylinder remains in an opened can, use it as soon as possible. Any defective cylinders, such as those with damaged closure plates, should be destroyed (par. 34). Moisture may affect the cylinders and all possible care should be taken to avoid prolonged exposure to dampness.

(2) Handling cylinders. Pressure on any of the five metal matches may ignite an incendiary charge in the cylinder. Care must be exercised to avoid putting pressure on the projecting ends of the matches except when firing the weapon. Ignition cylinders and cylinder containers should be protected against shock. Boxes and cans containing cylinders must not be thrown or dropped.

(3) Storing containers. Containers of ignition cylinders are best stored in a dry, well-ventilated place, out of the direct rays of the sun, well protected against excessive temperatures. Smoking is not permitted and matches are not used where ignition cylinders are stored.

## Section XX. PORTABLE FLAME THROWERS

### 60. Portable flame throwers M2-2 and M1A1.

Tank groups (fuel units) and fuel hose of portable flame throwers M2-2 or portable flame throwers M1A1 are required to operate the equipment described in this Technical Manual (unless fuel group of mechanized flame thrower is used). It is not necessary that the guns of these portable flame throwers be provided, but it may be found tactically desirable to bring the flame throwers with guns attached into the area of combat for possible use before the manifold is set up. Figure 1 shows portable flame throwers with hose (but without guns) connected to the manifold assembly for operation. Detailed instructions on portable flame throwers, given in TM 3-375 and TM 3-376A, must be familiar to all personnel concerned with operation of equipment described in this Technical Manual.

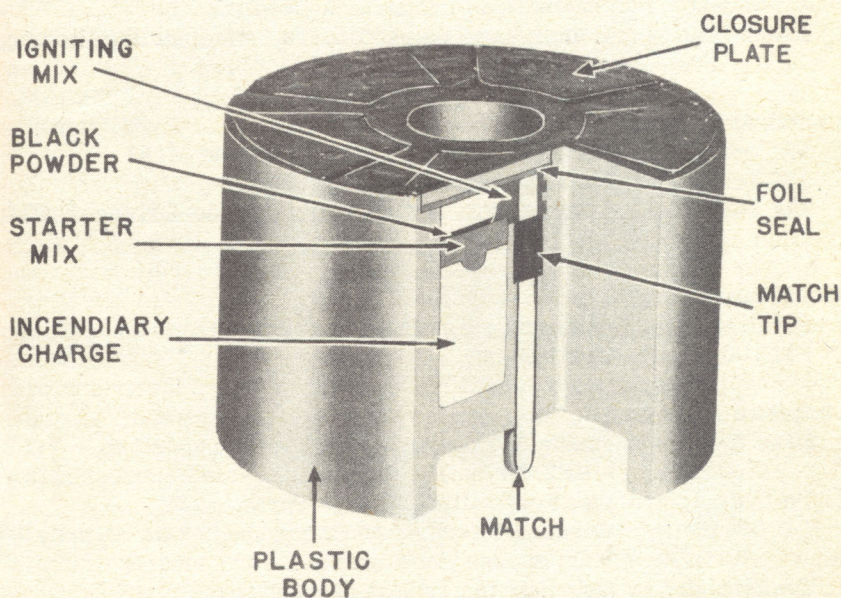


Fig. 44. Ignition cylinder (cutaway view).

# APPENDIX

## Section I. SHIPMENT AND STORAGE

The weapon is shipped, when new, in three packing boxes (fig. 45). If it is desired to ship or store the equipment after use, it should be returned to the packing boxes, if possible, or to improvised containers. Before storing in the boxes or containers, be sure that all after operation service (par. 41) has been carried out and that all exposed metal parts susceptible to rust are coated with rust preventive compound. Waterproof wrapping paper and nonhygroscopic adhesive tape should also be used, as required. Be sure hose exteriors and packboards are dry before storing. The gun and manifold assembly come packed together in one box. The other two boxes each contain a 100-foot length of hose and a quartermaster plywood packboard.

## Section II. REFERENCES

### Army Regulations:

- |           |   |
|-----------|---|
| AR 850-20 | Precautions in Handling Gasoline                                  |
| AR 850-60 | Compressed Gas Cylinders; Safe Handling, Storing, Shipping, Using |

### Technical Manuals:

- |           |   |
|-----------|---|
| TM 3-375  | Portable Flame Throwers M1 and M1A1               |
| TM 3-376A | Portable Flame Thrower M2-2                       |
| TM 3-377  | Compressor, Air, Gasoline Engine-Driven, 7CFM, M1 |

### Field Manuals:

- |          |  |
|----------|--|
| FM 31-50 | Attack on a Fortified Position and Combat in Towns |
| FM 100-5 | Operations   |

### Technical Bulletins\*:

- |             |  |
|-------------|--|
| TB CW 17    | Flame Throwers, Mechanized E4R2-5R1 and E4R2-4R3-5R1                                       |
| TB CW 18    | Kit, Fuel Filling, Flame Thrower, E6   |
| TB CW 20    | Cleaning Interiors of Compressed Gas Cylinders, Tanks and Accessories                      |
| TB ENG 39   | Safe Handling of Compressed Gases  |
| TB QM 13    | Clothing, Equipment, and Rations for Use in the Jungle (includes information on packboard) |
| TB 3-376A-1 | Pressure Tanks for Flame Thrower, Portable, M2-2   |

Army Service Forces Catalogs (Chemical Warfare Supply Catalogs):

CW 7-440114	Flame Thrower, Portable, M2-2
CW 7-440106	Flame Thrower, Portable, M1A1
CW 6-445115	Kit, Service, for Portable Flame Thrower, M2-2
CW 6-445103	Kit, Service, for Portable Flame Thrower, M1A1
CW 6-445901	Kit, Fuel Filling, Flame Thrower, E6
CW 7-631110	Compressor, Air, Gasoline Engine Driven, 7CFM, M1

\* Technical Bulletins are to be superseded by War Department Technical Manuals or changes to manuals.

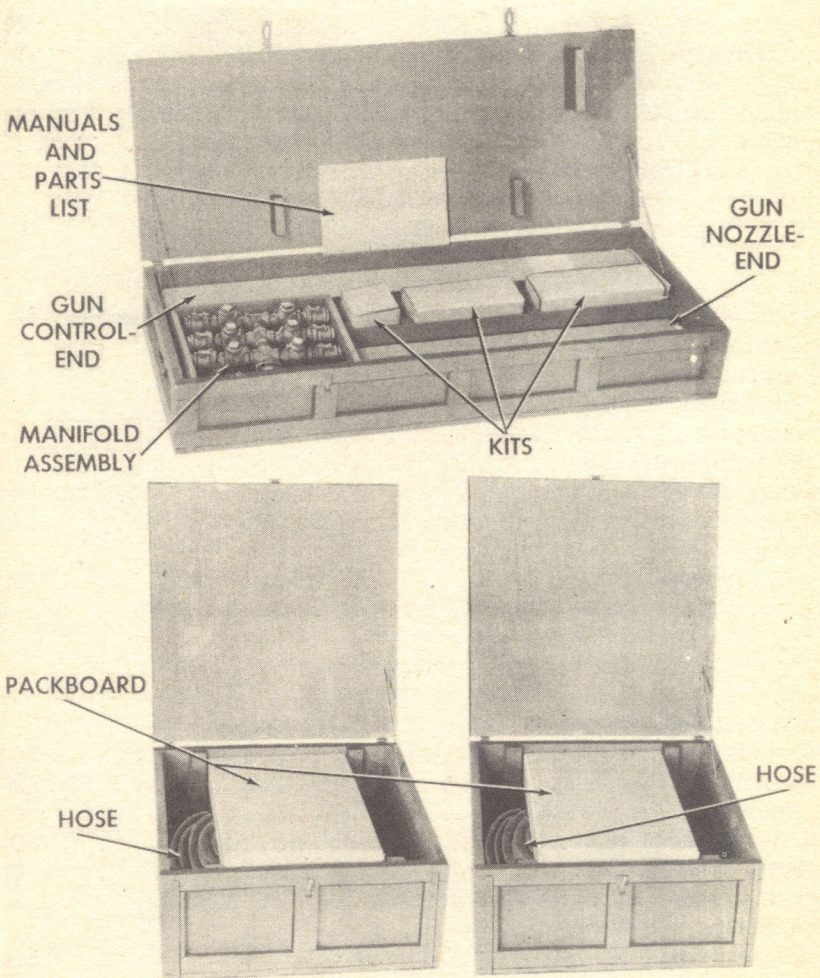


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